TM 9-1826A

WAR DEPARTMENT TECHNICAL MANUAL

U.S. Dept of Army

ORDNANCE MAINTENANCE

Carburetors (Carter)

WAR DEPARTMENT • *11 FEBRUARY 1944*

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Washington 25, D. C., 11 February 1944

TM 9-1826A, Ordnance Maintenance—Carburetors (Carter), is published for the information and guidance of all concerned.

[A.G. 300.7 (30 Nov 43)
O.O.M. 461/Raritan Arsenal (16 Feb 44)]

BY ORDER OF THE SECRETARY OF WAR:

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(For explanation of symbols, see FM 21-6.)

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CHAPTER 1

INTRODUCTION

1. SCOPE.

a. The instructions contained in this manual are for the information and guidance of personnel charged with the maintenance and repair of Carter carburetors. These instructions are supplementary to field and technical manuals prepared for the using arms. This manual does not contain information which is intended primarily for the using arms, since such information is available to ordnance maintenance personnel in 100-series technical and field manuals.

b. This manual contains a description of, and procedure for disassembly, inspection, repair, and reassembly of the Carter carburetors listed below.

Model Number	Type
420S, 483S, 515S, 556S, 570S, 574S	W-1
450S, 539S, 567S, 572S	W-0
D6A2, D6B2, D6C2, D6G1, DTA2, DTB2, DTC1, ETP2, ETR1, ETT1, EL1	Ball and ball (downdraft)
447S, 489S, 517S, 6C2, 6D1, 6E1, 6F1, 6G1, 6J1, 6K1, BB1A	Ball and ball (updraft)
T1-A, T2-A, T3-A, T4-A, T5-A, T1B, T2B, T3B, T4B, T5B, TD1, TD2, TX-1, TX-2, TX-3, TX-4, TX-5, 561S, 577S, ETWI	Ball and ball (with built-in governor)
553S, 564S, 566S	WCD

2. MWO AND MAJOR UNIT ASSEMBLY REPLACEMENT RECORD.

a. Description. Every vehicle is supplied with a copy of AGO Form No. 478 which provides a means of keeping a record of each MWO completed or major unit assembly replaced. This form includes spaces for the vehicle name and U. S. A. Registration Number,

instructions for use, and information pertinent to the work accomplished. It is very important that the form be used as directed and that it remain with the vehicle until the vehicle is removed from service.

b. Instructions for Use. Personnel performing modifications or major unit assembly replacements must record clearly on the form a description of the work completed and must initial the form in the columns provided. When each modification is completed, record the date, hours and/or mileage, and MWO number. When major unit assemblies, such as engines, transmissions, transfer cases, are replaced, record the date, hours and/or mileage and nomenclature of the unit assembly. Minor repairs and minor parts and accessory replacements need not be recorded.

c. Early Modifications. Upon receipt by a third or fourth echelon repair facility of a vehicle for modification or repair, maintenance personnel will record the MWO numbers of modifications applied prior to the date of AGO Form No. 478.

CHAPTER 2

GENERAL DESCRIPTION AND OPERATION

Section I

PURPOSE AND PRINCIPLE OF OPERATION

3. PURPOSE OF A CARBURETOR.

a. The purpose of the carburetor is to supply the correct mixture of fuel and air for any and all conditions of speed and/or load imposed upon the engine. The engines of present day vehicles must be completely flexible in speed range from approximately 500 revolutions per minute to more than 3,000 revolutions per minute. At any point in this range, the vehicle may be subjected to a comparatively light load or a very heavy load. It must adapt itself immediately to any change of load or speed imposed upon it, within the limits of its maximum power output.

b. The carburetor must function throughout this range to secure maximum power with optimum economy. A mixture which is too rich not only wastes fuel, but may damage the engine through crankcase dilution. On the other hand, a lean mixture will result in a loss of power and, under certain conditions, may damage the engine through excessive heat. Therefore, it is apparent that complete and careful service must be given the carburetor after use, if it is to operate within the close limits necessary in the present day engine.

4. BASIC PRINCIPLE.

a. The fuel is delivered from the carburetor to the engine because a greater pressure exists in the carburetor bowl than in the engine manifold. The higher pressure in the bowl actually pushes the fuel through the metering jet into the low pressure air stream in the throat of the carburetor.

b. A common example of this operation is the conventional insecticide gun, illustrated in figure 1. The spray gun bowl contains a liquid and is comparable to a carburetor fuel bowl. The bowl is covered to prevent spilling and is equipped with a vent, as is a carburetor bowl. The nozzle (a small tube open at both ends) is inserted below the fuel level, and extends well above the liquid. The stream of air is directed across the exposed end of the nozzle by

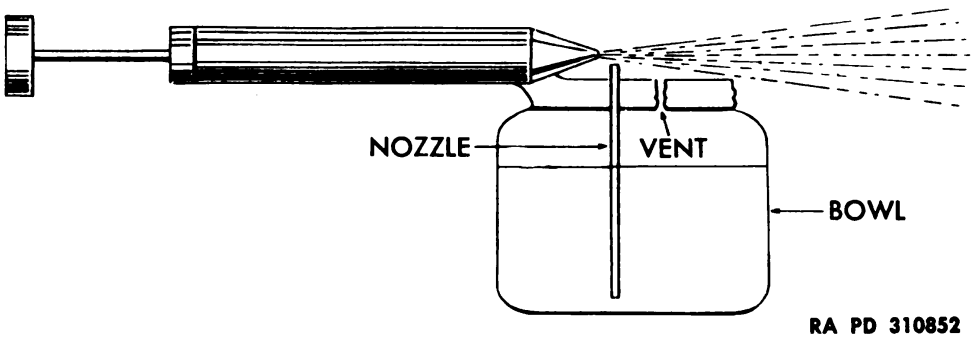

Figure 1 – Basic Principle of Operation

means of a hand pump. The velocity of this stream of air over the tip of the nozzle reduces the pressure at this point. Atmospheric pressure admitted to the bowl through the vent, pushes the liquid up the tube to the low pressure point, where it is picked up by the air stream. Obviously, the same principle applies even though the nozzle is inserted on an angle, as it is in most carburetors.

Section II

THE FIVE CARBURETOR CIRCUITS

5. INTRODUCTION.

a. In order to more easily understand the operation of the carburetor, and to provide the repair man with a more satisfactory method of carburetor overhaul, it has been found practical to consider the carburetor to be made up of five circuits or systems. These are:

(1) Float circuit.
(2) Idle or low speed circuit.
(3) High speed circuit.
(4) Pump circuit.
(5) Choke circuit.

If, in the overhaul of the carburetor, each of the circuits is carefully checked and put back to standard, the unit will function satisfactorily as a whole. If, while overhauling the unit, the mechanic neglects any portion of any circuit, the operation of the unit is most certain to be unsatisfactory.

b. The carburetor is a precision instrument. Carburetor repair consists of rebuilding the unit back to original specifications.

c. An effective example of the precision task of the modern carburetor is that in an average mile of operation, a typical carburetor must meter approximately 9 cubic inches of gasoline mixed with 50 cubic feet of air, and that under ali conditions of speed and load, the mixture must be kept within the close limits of optimum economy and maximum horse power.

6. FUNCTION OF THE FIVE CIRCUITS.

a. Float Circuit. The function of the float circuit is to maintain the correct fuel level in the fuel bowl at all times. This proper level combined with a calibrated vent, will make available the correct amount of fuel to the other circuits. NOTE: *The successful operation of the other circuits in the carburetor is primarily dependent upon the proper functioning of the float circuit.*

b. Low Speed Circuit. The function of this circuit is to deliver the proper mixture of fuel and air when the throttle is practically closed. It functions throughout the entire speed range in some carburetors, whereas in others it ceases to function after the high speed circuit is in full operation. It provides a means of delivering fuel from the bowl to a point on the engine side of the throttle valve (through the idle porthole).

c. High Speed Circuit. The function of the high speed circuit is to meter and deliver the proper amount of fuel in the range of speed and load above practically closed throttle.

d. Pump Circuit. The function of the pump circuit is to quickly provide a measured supply of fuel necessary for sudden acceleration. Most pump circuits are operated mechanically by means of a connecting lever to the throttle.

e. Choke Circuit. The function of the choke circuit is to provide a means of enriching the mixture when starting, and warming, a cold engine.

7. OPERATION OF THE FLOAT CIRCUIT.

a. Function. In the conventional carburetor, fuel is supplied to the carburetor bowl either by pump pressure or by gravity feed.

The pressure of gasoline entering the carburetor is important, because it controls the height of the gasoline level in the nozzle and the various passages in the body casting, as well as in the bowl. In order for the float circuit to operate efficiently, the specified fuel pump pressure is pertinent. Inasmuch as the gasoline is pushed from the bowl into the various passages, a "bowl vent" must be provided to allow air to enter the float chamber. The carburetor as discussed in the following pages employs one of two types of bowl vents. The first is the outside vent; the second is the inside or "balanced" vent.

b. Bowl Vents. The outside vent is merely a hole of predetermined size, suitably located in the bowl cover of the carburetor, which permits the atmosphere to enter, or leave, the bowl. In the inside vented or "balanced" type carburetor, the air entering the bowl vent must first go through the carburetor air cleaner. In the balanced type carburetor, the ratio of fuel and air remains the same despite the physical condition of the air cleaner employed. As the carburetor air cleaner becomes dirty, and hence restricted, the amount of air that passes through the carburetor at a given throttle opening will be decreased. As the air passing through the throat of the carburetor is restricted, the air available to the inside or "balanced" vent is restricted in the same proportion. A restricted air cleaner on any carburetor limits the capacity of the carburetor, but the balanced carburetor always maintains a correct air-fuel ratio despite the air cleaner restriction.

c. Operation. The fuel enters the bowl through the needle seat. As the fuel rises in the bowl, the float closes the needle at the proper fuel level. This proper fuel level is controlled by the setting of the float. The float circuit consists of the needle valve and seat, float and pin, the float bowl, bowl cover and gasket, and the bowl vent. All of these items must be considered when servicing the float circuit of the carburetor.

8. OPERATION OF THE LOW SPEED CIRCUIT.

a. Function. The idle circuit completely controls the supply of fuel and air to the engine during idle and light load speeds.

b. Operation. The fuel is pushed through a calibrated hole in the idle tube or jet. The fuel then flows into a passage where it mixes with a small amount of air admitted from the carburetor throat. The fuel and air next pass through a restriction called an "economizer," which limits the flow of the idle circuit and accomplishes a more complete mixing of the fuel and air. In some models, an additional small supply of air is admitted as the mixture is conducted through the passage to the low pressure discharge point (idle port hole). This passage actually has two outlets, the idle port adjacent

to the throttle valve (when it is closed), and the idle adjustment screw hole. In operation, the bulk of the mixture is discharged from the idle port; an additional amount, adjusted to the engine needs, is discharged through the idle adjustment screw hole. Turning the screw toward the seat decreases the volume of the mixture discharged and vice versa. In other words, a leaner idle mixture is obtained by turning the idle adjustment screw in, and conversely, backing out the idle adjustment screw will produce a richer idle mixture. The gasoline and air mixture that is discharged through the idle port hole and the idle adjusting screw hole is richer than the idle mixture needs to be, but when it mixes with the air, which has come past the throttle valve, it forms a combustible mixture of the right proportion for idle operation.

c. As the throttle opening is increased, more air passes the throttle valve and more of the idle port is exposed to the air stream. This permits more fuel to be discharged. By predetermining the size and shape of the idle port hole, the quantity of mixture at a predetermined throttle valve position, can be controlled to suit the needs of a particular engine. The idle position of the throttle is such that at an idle speed of 6 to 7 miles per hour, it leaves enough of the port as reserve to cover the range in speed between idle and the time the high speed circuit begins to function. A short distance beyond the idle position of the throttle, sufficient air passes through the carburetor to start the high speed circuit functioning. It should be remembered, however, that the idle circuit does not stop functioning at this time. For considerable travel of the throttle, after the high speed circuit has commenced to work, the idle circuit continues to deliver fuel. This delivery of fuel from the idle circuit gradually diminishes as the high speed circuit increases its delivery of fuel.

d. No arbitrary figure should be set at which point the idle circuit may be said to cease functioning. In the first place, this would vary from one model carburetor to another, and, second, this point is extremely difficult to detect even with the finest engineering facilities.

9. OPERATION OF THE HIGH SPEED CIRCUIT.

a. Function. The method of discharging fuel from this circuit is explained in figure 1, comparing the insecticide spray gun to the carburetor fuel bowl and nozzle. Just above idle speed, sufficient air passes through the carburetor venturi to decrease the pressure at the tip of the discharge nozzle. As in the case of a spray gun, the liquid is then pushed out of the nozzle by the bowl pressure. As the throttle opening is increased, additional fuel must be supplied to the nozzle to mix with the increased volume of air passing through

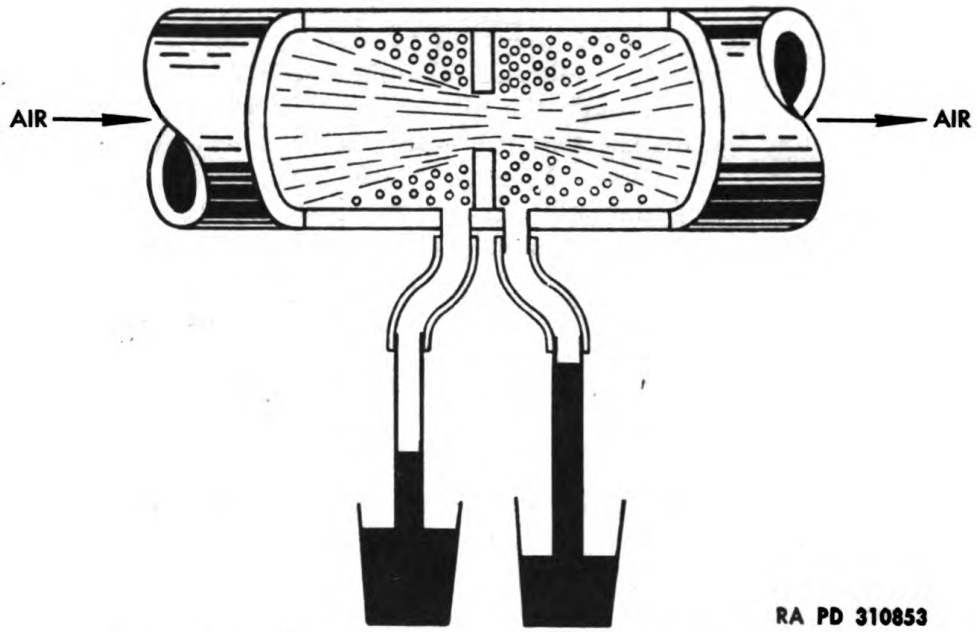

Figure 2 — Action of Air Passing Through Tube with Sharp Edge Restriction

the carburetor. However, when the throttle approaches the wide open position and the engine is given the chance to develop its maximum horse power, the mixture must be further enriched. Failure to enrich the mixture at this time, will not only result in a loss of power, but may also result in serious mechanical damage to the internal parts of the engine. Methods of enriching the power mixture will be explained specifically as each of the various types of Carter carburetors are discussed.

b. The Venturi System.

(1) In order to build up the speed of the air passing the nozzle tip, carburetors are equipped with one or more Venturi tubes located in the carburetor throat. The function of a Venturi tube is to increase the velocity and decrease the pressure of the air passing through it. Not only does the increased velocity of air beyond the nozzle tip improve the atomization of the fuel, but the consequent decrease in pressure at the nozzle enables the high speed circuit to function when a relatively small amount of air is passing through the carburetor.

(2) If air is passed through a tube in which a sharp edge restriction is located, the flow of the air will be like that shown in figure 2. The pressure of the air, after it passes through the restriction, is less than when it entered the tube. This is shown by the difference in

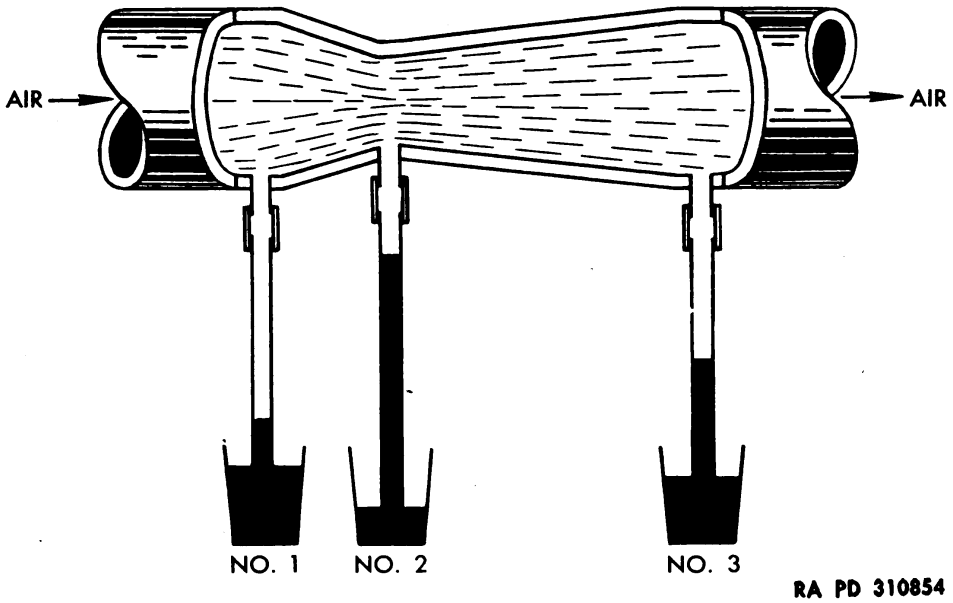

Figure 3 — Action of Air Flowing Through a Venturi Tube

the liquid columns of the attached manometers. (A manometer is an instrument used to measure vacuum. A simple manometer consists of a container of water and a glass tube, the upper end of which is connected to the point at which the pressure is to be measured (fig. 2). Reading is obtained by measuring distance from top of column to the surface of the outer liquid. Many types of liquids are used, water and mercury being most common.) However, such a restriction would probably result in air turbulence. If the dead air space (shown as small circles) were filled in with some material, it would then be a venturi and the flow of air through the tube would be much smoother. Figure 3 shows a venturi with manometers attached to the three critical locations. Note that the column of water is highest on manometer No. 2 (the point of greatest restriction), and that there is a slight depression at manometer No. 3. Manometer No. 3 must show more depression than manometer No. 1 in order to have a flow of air through the tube. Thus it can be readily seen that the lowest pressure (highest vacuum) is at the point of greatest restriction.

(3) By building a stack of three venturis so that the trailing edge of one will be at the narrowest point of the succeeding venturi, and installing manometers in the throat of each venturi and at the base of the largest, it can be seen that if air is passed through the tube, it will pass through all the venturis and the build-up of each venturi will be passed on to the succeeding venturi. The vacuum in the smallest venturi will be much greater than that at the base of

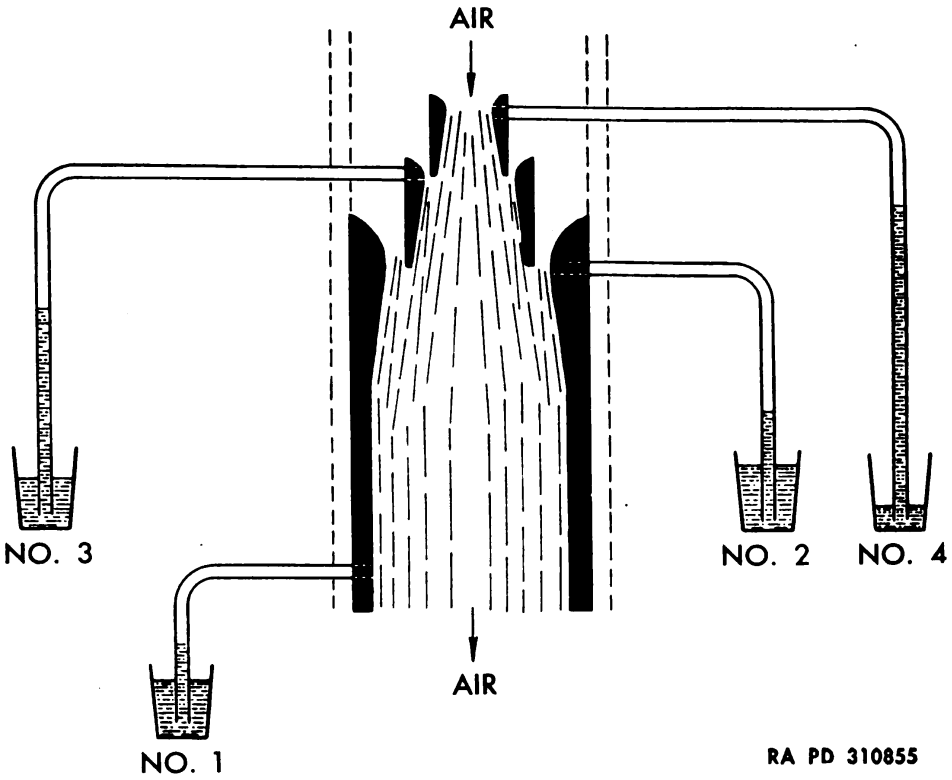

Figure 4 — Depressions in a Triple Venturi System

the main venturi (fig. 4). As the amount of air passed through the tube is increased, the vacuum build-up will be increased throughout the entire system.

(4) By inserting the high speed nozzle at the point where manometer No. 4 (fig. 4) is attached, the delivery of gasoline through the high speed circuit will begin at a much lower motor speed than if it were attached at the point of manometer No. 2. Carter W-1 carburetors use this triple venturi system which when applied to a carburetor will appear as shown in figure 5.

c. Metering Rods. It is necessary to measure the amount of gasoline allowed to enter the nozzle as it must be proportioned to the amount of air passing through the carburetor. Carter W-1, W-0, and WCD carburetors use metering rods in the metering jets. Dissimilar engines require different air fuel ratios at certain speeds. By using a rod, the lower end of which has been made smaller, it is possible to vary the amount of gasoline passing through the metering jet. The rod is connected mechanically to the throttle so that, as the valve is opened, the rod rises. The higher the rod is raised in the jet, the greater is the opening. Metering rods are made with

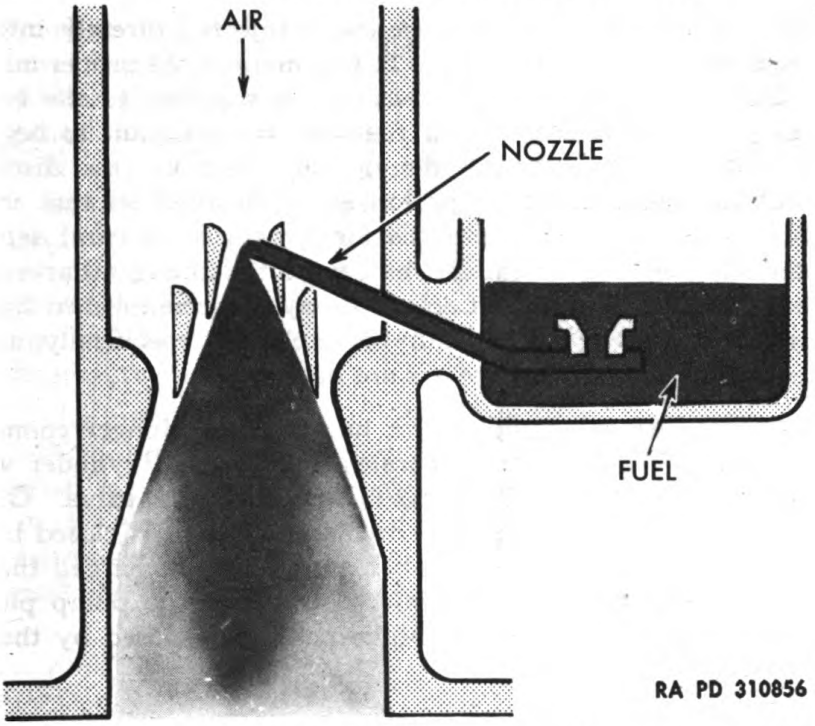

Figure 5 — Application of a Triple Venturi to a Carburetor

various combinations of tapers and steps, calibrated to suit the requirements of a particular engine. Some rods have two or three steps, whereas others use steps with tapered portions between. The metering rod position must be synchronized with the throttle valve position so that the proper ratio of air and gasoline is delivered to the motor for all speeds and driving conditions. This is a mechanical operation and must be done whenever servicing a carburetor. It is known as "Metering Rod Adjustment." This operation will be fully described under "Metering Rod Adjustment" in chapter 3. Other types of Carter carburetors use a different method of enriching the mixture for power and high speed operation. The ball and ball type carburetors use a vacuum operated step-up. It will be fully described under the chapters covering those carburetors.

10. OPERATION OF THE PUMP CIRCUIT.

a. The primary purpose of the accelerating pump circuit is momentarily to supply gasoline to the air stream as the throttle is suddenly opened when the vehicle is traveling at low speeds. When the throttle is suddenly opened, the velocity of air entering the carburetor is great, but the fuel, being a heavy liquid, moves slowly. Consequently, the charge in the cylinders is momentarily very lean. To supply the necessary mixture under these conditions, as the

throttle is opened, a charge of gasoline is injected directly into the air stream by means of the pump. In this manner the proper mixture of air and fuel for accelerating purposes is supplied to the engine. It may require a few seconds for the high speed circuit to begin to deliver sufficient fuel through the nozzle; therefore, the discharge action of the pump must be prolonged or delayed so that it will continue to discharge fuel into the air stream for several seconds, even though the mechanical movement of the plunger has ceased. This is known as "delayed action" and may be accomplished by several methods each of which will be explained specifically as the various types of Carter carburetors are discussed.

b. A conventional pump circuit has a pump plunger connected to the throttle. The plunger operates in a vertical cylinder which receives fuel from the bowl through a suitable check valve. On the upward stroke of the plunger, the discharge passage is closed by another check valve. Conversely, when the fuel is discharged through a jet into the air stream by downward travel of the pump plunger (as the throttle is opened), the intake passage is closed by the first check valve.

11. OPERATION OF THE CHOKE CIRCUIT.

a. The choke circuit supplies a ready means of restricting the amount of air passing through the carburetor. This restriction and resulting rich mixture is necessary when starting and warming a cold engine.

b. Chokes are of two types; manual and automatic. Carburetors described herein employ both types. The manual choke mechanism in the conventional carburetor consists of a valve mounted on a shaft in the air horn of the carburetor, operated by an external lever attached to the shaft. Manual operated choke valves of this type usually have a semi-automatic feature which prevents over-choking after starting. This feature is accomplished by spring-loading, either all or half of the valve, or by incorporating a spring-loaded poppet device in the valve. Some models use both means to improve choke action.

12. INTERDEPENDENCY OF THE FIVE CIRCUITS.

a. Although the five circuits of the carburetor have been treated independently for the purpose of simplifying the explanation, a word of caution is advisable here as to the interdependency of the different circuits. If the float circuit is not up to standard, the supply of fuel for the operation of the low speed, high speed, and pump circuits will be affected, and hence the operation of all three circuits may be hampered. It has been pointed out that the operation of the low

speed circuit does not cease when the high speed circuit starts to function. Similarly, in some cases, notably on units built for Chevrolet Motor Company, since 1934 there is an interdependency between the high speed and pump circuits. On these units the pump circuit delivers a small quantity of fuel at part throttle and higher engine speeds, although the throttle is held steady and the pump plunger is not in motion. This is called "pump bleed" or "pump pull-over," and the unalterably designed feature of this pump permits it to discharge this fuel in the same manner as fuel is discharged from the high speed circuit. When the unit is properly serviced, this built-in feature will take care of itself.

b. The interdependency of the circuit is not emphasized to add technical confusion to the mind of the service man, but rather to show that, for the absolute precision operation, of which the carburetor is capable, all five circuits must be carefully serviced. No snap judgment should be made in diagnosing carburetor trouble, and no "favorite" should be played when circuits are serviced.

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ORDNANCE MAINTENANCE — CARBURETORS (CARTER)

CHAPTER 3

TYPE W-1 CARBURETOR, MODELS 483S, 515S, 556S, 570S, AND 574S

Section I

DESCRIPTION

13. FLOAT CIRCUIT.

a. Function. These carburetors all have an inside vent, sometimes called a "balanced" vent. This is accomplished by a tube which projects into the carburetor air horn above the choke valve. Air entering the tube passes down through a passage into the cast iron body. Here its direction is reversed out of the cast iron body up into the inside of the bowl cover. See fig. 7.

This irregular passage is so designed as to preclude the possibility of fuel in the bowl splashing into the vent passage. A small round gasket between the air horn and the cast iron body seals the connection in the vent passage, and a new gasket should be used each time the air horn is installed. A faulty seal at this point, or a leak in the bowl cover gasket, will result in an air leak to the atmosphere which will upset the "balanced" feature of the carburetor.

14. LOW SPEED CIRCUIT.

a. Function. Fuel, from the carburetor bowl, is pushed through the calibrated hole in the low speed jet, and flows into the low speed jet passage. At the top of this passage, air is admitted from the carburetor throat through the bypass hole. The fuel and air then pass through a restriction in the cross passage, called the economizer, and from this point the mixture flows down the passage terminating at the idle port and idle adjustment screw hole. In operation the bulk of the idle circuit mixture is discharged from the idle port; an additional amount, adjusted to the engine's needs, is discharged from the idle adjustment screw hole. Turning the screw toward the seat

TYPE W-1 CARBURETOR, MODELS 483S, 515S, 556S, 570S, AND 574S

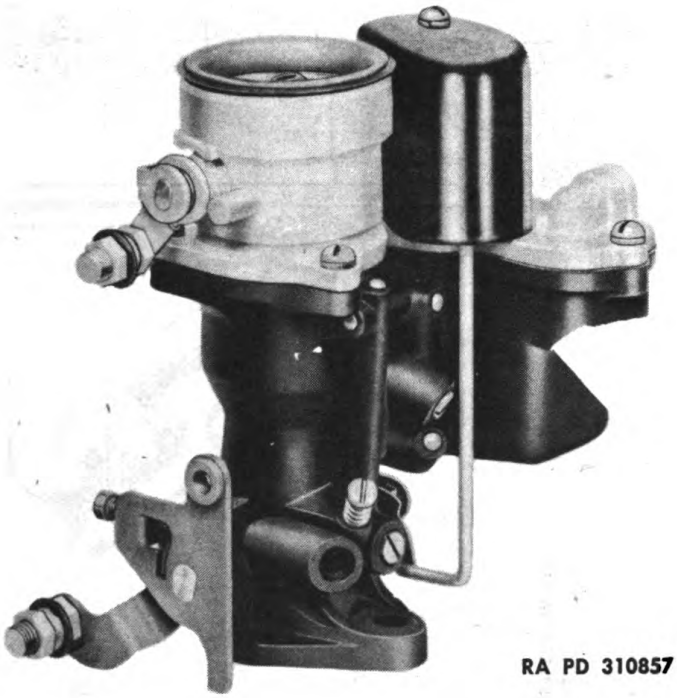


Figure 6 — Typical W-1 Carburetor

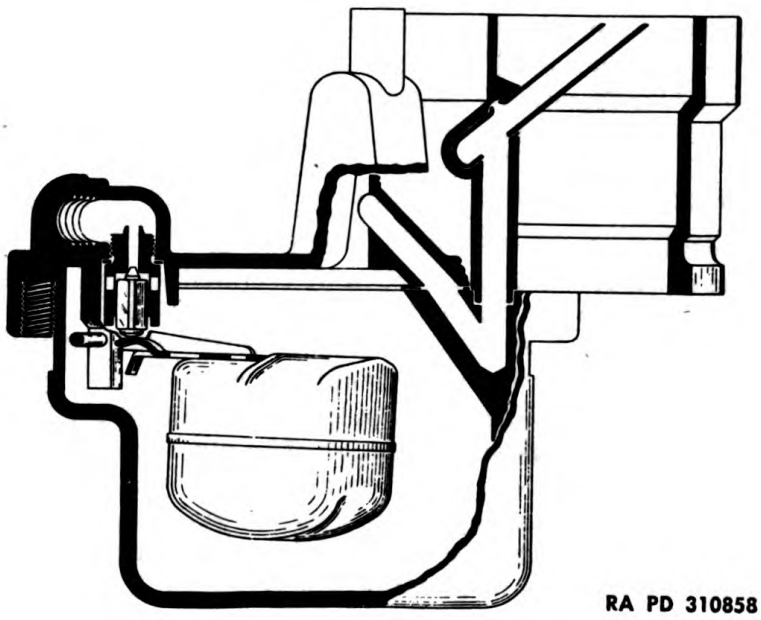


Figure 7 — W-1 Float Circuit

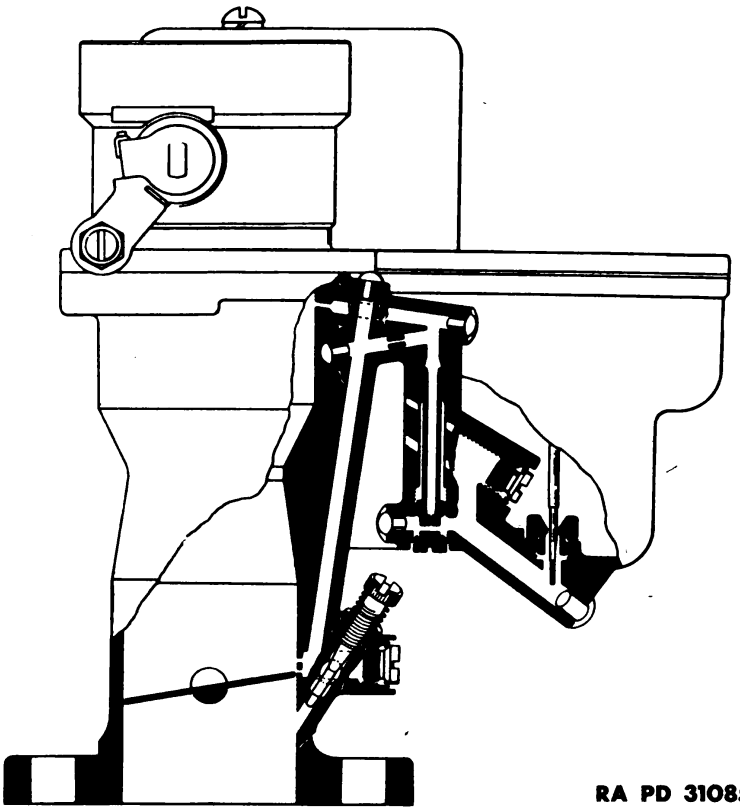


Figure 8 — W-1 Low Speed Circuit

decreases the volume of the mixture discharged and vice versa. Hence, a leaner mixture is obtained by turning the idle adjustment screw in and, conversely, backing the idle adjustment screw out produces a richer idle mixture.

15. HIGH SPEED CIRCUIT.

a. Function. Fuel is metered to this circuit from the bowl through the calibrated orifice provided by the metering rod jet and the metering rod within it. From this point the fuel flows through a passage to the nozzle assembly which extends into the smallest of the three venturis in the air horn. In chapter 2, paragraph 9, it is stated that this is the point of highest air velocity, and the point of greatest depression, within the carburetor throat. The difference in pressure at the nozzle tip, and the greater pressure on the gasoline within the bowl, causes the high speed circuit to operate. As the throttle valve is opened, the increased volume of air passing through the carburetor, multiplies this difference in pressure. Thus a ratio is established between the volume of air passing through the carburetor and the volume of gasoline ejected into the air stream. The metering rod is raised

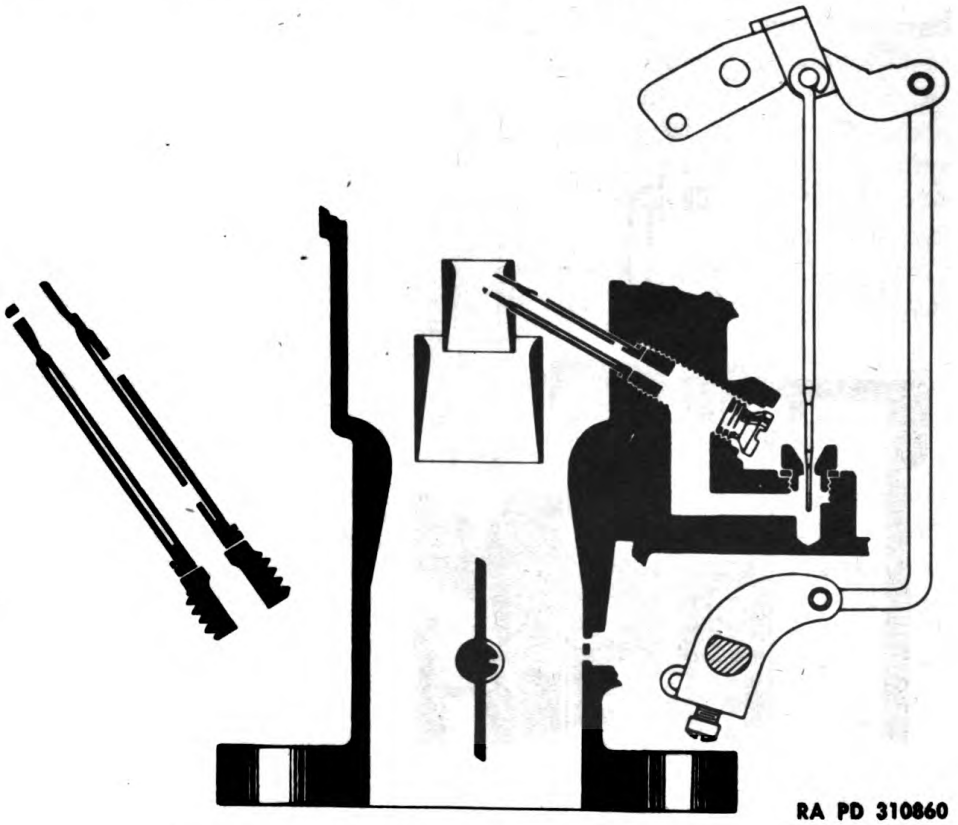


Figure 9 — W-1 High Speed Circuit

mechanically in the jet as the throttle valve is opened, thus increasing the size of the opening and in this way maintaining the correct air fuel ratio for all operating conditions. The small section of the metering rod (at the lower end) is in the jet at wide open throttle, automatically enriching the mixture for wide open throttle operation.

b. Metering Rod and Jet. The metering rod has several tapered steps machined at the lower end. As it is raised in the jet, the effective size of the fuel orifice becomes greater, thus permitting more fuel to flow through the circuit to meet the load demand imposed upon the engine. Both metering rod and jet which control the flow of fuel for the high speed circuit are machined to a tolerance of two-and-one-half ten thousandths of an inch (0.00025 in.).

c. The Nozzle Assembly consists of two pieces which are permanently pressed together. Around the annular space, which exists between the outer and inner part of the nozzle, a quantity of air is present. This air enters through the hole in the upper side of the nozzle, and then travels down toward the base of the nozzle assembly, and mixes with the fuel. Air entering at this point assists in the atomization of the fuel. It is known as an "air bleed" nozzle.

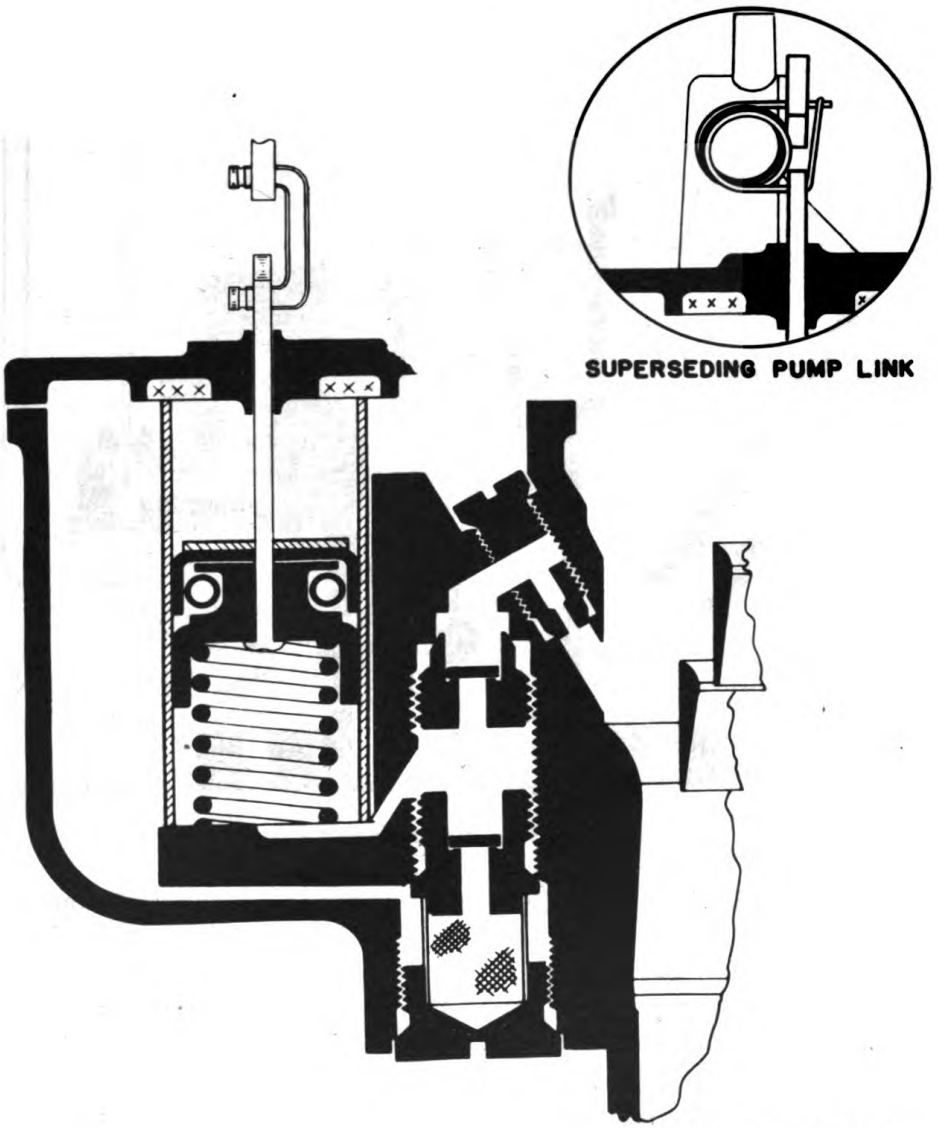


Figure 10 — W-1 Pump Circuit

16. PUMP CIRCUIT.

a. Function. As explained in paragraph 10, accelerating pump action is necessary when the throttle is suddenly opened at low speeds. The action is as follows: When the throttle is closed, the linkage raises the plunger assembly toward the top of the pump cylinder. On this stroke of the pump, a quantity of fuel from the bowl flows through the intake disk check valve and into the pump cylinder. At this time the discharge check valve is on its seat, preventing air

from entering the pump circuit. The check valves are protected from dirt by a suitable screen located directly beneath them. When the throttle is opened, the linkage forces the plunger down and the fuel beneath it is pushed out of the pump cylinder back to the check valve passage. The pressure of the fuel forces the intake check valve to its seat, thus preventing the return of the fuel to the bowl. The discharge check valve, just above, is forced off its seat and the fuel passes through it to the pump jet, where it is discharged in a finely metered stream. When the throttle is closed again, the pump cylinder is filled as before.

b. Delayed Action. The successful operation of the accelerating pump depends on a delayed action, which provides a continual stream of fuel from the pump jet, after the throttle has ceased moving. This is to take care of the fuel demands of the engine in the interval that exists between the time the throttle is opened and the time the high speed nozzle begins to discharge its fuel. Chevrolet carburetors achieve this action in the following manner, sometimes referred to as a "dry pump": Between the plunger leather and the fuel, a pocket of air is maintained in the plunger cup. When the plunger is pushed down, it compresses this air. The compressed air, in turn, forces the fuel from the pump cylinder. At the end of the plunger stroke, the compressed air expands, providing the necessary force to continue the fuel discharge. Some Chevrolet models use a pump connector link spring instead of the regulation pump connector link. This spring is shown in the circle in figure 10. Its purpose is twofold, one is to assist in the delayed action of the pump discharge. When the throttle is opened suddenly, the plunger is driven down in the cylinder, but the spring is also slightly compressed. As the spring expands to its normal position, it aids in pushing the plunger against the air pocket and thus assists in the delayed delivery of fuel through the pump jet. Secondly, since this spring is not a rigid member between the pump plunger and the pump arm, it will absorb the strain on the linkage, should the pump jet become obstructed.

17. CHOKE CIRCUIT.

a. Function. When the choke is used, the mixture is enriched by cutting down the amount of air admitted through the carburetor. These Chevrolet carburetors use a choker valve with a semi-automatic feature, which is brought about by operating the choke through a coiled spring on the end of the choke shaft. This spring action, combined with an off-center choker valve, enables the valve to breathe with the engine during the choking period. This breathing action also minimizes the possibility of overchoking.

18. INTERDEPENDENCY OF THE CIRCUITS.

a. As described in chapter 2, paragraph 12, the pump circuit in these carburetors has another function; that of delivering a small metered quantity of fuel to the engine, even though the throttle is held in a fixed position. This feature is called "pump bleed." It has been shown before that the passage of air past the tip of the jet will enable it to deliver fuel to the air stream, provided the jet is connected to a source of fuel which is under a higher pressure. Air passes down through the air horn past the lower end of the pump jet passage which is connected to the careburetor bowl by the check valve passage. From part throttle to wide open throttle, fuel from the carburetor bowl is pushed through the disk check valves and out the pump jet. This fuel is a definite part of the engine's demands and is an essential part of the carburetor calibration. In order to insure the uninterrupted flow of fuel at the required time, disk check valves of light weight are employed in this carburetor. These should never be replaced with check valves of any other type. When the unit has been properly serviced with the correct parts, this feature will automatically take care of itself. Under no condition should a service man attempt to alter this feature. Whether or not a carburetor employs "pump bleed" is a prime concern of the designing engineer.

Section II

DISASSEMBLY

19. DISASSEMBLY.

a. Remove and Disassemble Bowl Cover. Disconnect throttle connector rod at pump arm, then remove bowl cover attaching screws and lift bowl cover with all parts attached. Remove metering rod, float pin, needle and seat, pump link and plunger, pump arm and collar assembly.

b. Remove and Disassemble Air Horn. The nozzle assembly extends into the primary venturi of the air horn. Therefore, it is necessary to remove the nozzle passage plug, the nozzle retainer plug, and the nozzle assembly before the air horn can be removed. Then remove air horn attaching screws and lift off air horn assembly. Remove choke valve attaching screws and slide choke shaft from air horn. Do not damage choke spring when removing shaft.

c. Disassemble Body Casting. Removal of parts from the body

casting can be effected with a minimum change of sizes of screw drivers, and shifting of casting, if performed in the following sequence:

(1) Pump jet plug and pump jet.
(2) Metering rod jet.
(3) Idle adjusting screw and spring.
(4) Idle port plug.
(5) Check valve passage plug, strainer, intake and discharge check valves.
(6) Low speed jet.
(7) Throttle shaft arm and throttle connector rod.
(8) Throttle valve, throttle shaft and lever assembly.

Section III

CLEANING, INSPECTION, REPAIR, AND ASSEMBLY

20. CLEANING AND INITIAL INSPECTION.

a. Body Casting. The idle passages, the idle bypass hole, and the economizer in the casting must be absolutely clean. Soak the casting for a short time in dry-cleaning solvent, then blow out with compressed air. The carburetor bore must be free from carbon deposit around the throttle valve. This carbon deposit, to which all carburetors are subjected after prolonged low speed operation, is generally overlooked by the untrained carburetor serviceman, and no one cause will contribute so much to a rich idle and low speed operation as this carbon deposit.

b. Air Horn and Bowl Cover. Soak parts in dry-cleaning solvent or any approved cleaner, and blow out with compressed air. Inspect air horn for "out of round," dents in venturis and wear in choke shaft bearings. Check bowl cover for warpage.

c. Repair Parts Package. A wire basket usually facilitates the cleaning of the small parts. Parts which are to be replaced, such

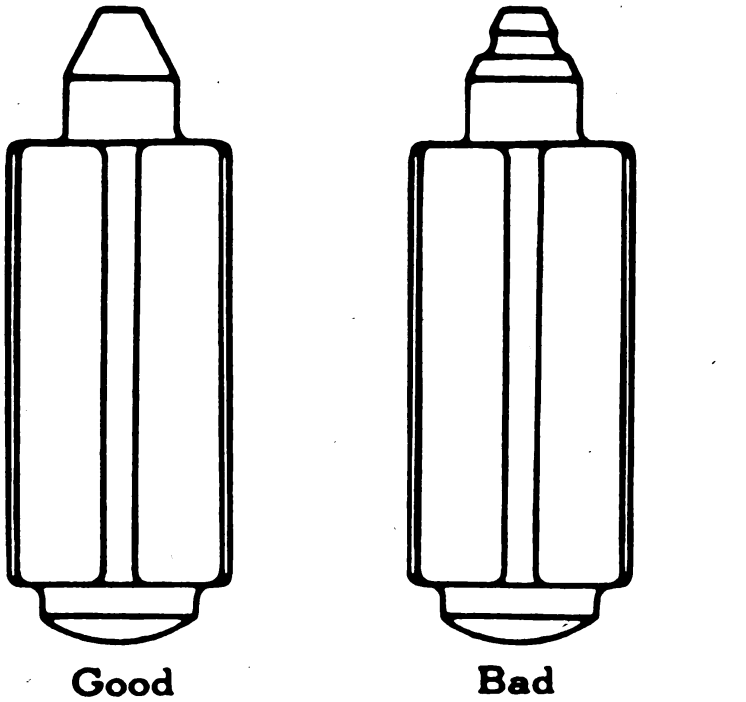


Figure 11 — Comparison of New and Worn Gasoline Intake Needles

as low speed jet, gaskets, etc., need not be cleaned. When carburetor is completely overhauled, the installation of a repair parts package is recommended and includes the following parts: low speed jet, nozzle assembly, float pin, needle and seat, pump jet, strainer, pump arm, pump plunger, metering rod and jet, throttle shaft lever, throttle connector rod, pump checks, metering rod disk, and all necessary gaskets, plugs, screws, felt packing springs and retainers for complete service.

d. Inspection of Major Parts. After body casting has been cleaned as recommended in paragraph 20 **a**, the following inspection should be made to be sure that:

(1) Nozzle gasket has been removed from high speed passage.

(2) All carbon accumulation in the bore of the carburetor has been removed.

(3) All passages are clear of carbon and dirt.

(4) Idle port is clean and has not been damaged.

(5) All shoulders for seats of check valves, low speed jet, nozzle, and screw plugs have not been damaged.

(6) Bottom of float bowl does not show rust, indicating presence of water. (Remove all rust with wire brush, and paint inside of bowl with a good grade of auto body lacquer.)

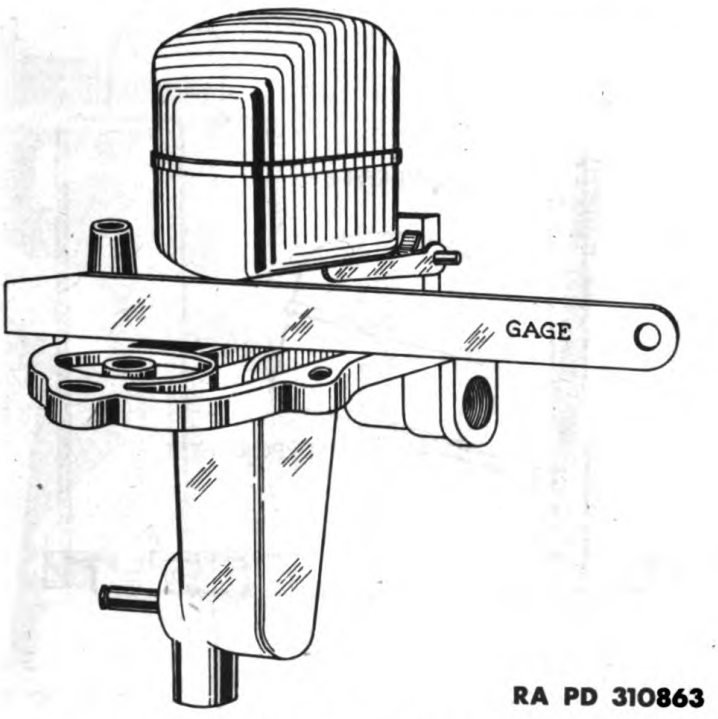


Figure 12 — Gaging Float with Gage 41-G-196-25

21. CIRCUIT SERVICE METHOD.

a. The overhauling of carburetors by the Circuit Service Method is the fastest simple method. By grouping the parts and the installation of such parts in groups, it will usually be found that each group can be installed as a unit before proceeding to the next group. It will be necessary to divert from this system only when installing one or two parts. It is suggested that the serviceman use a sectionalized pan or muffin tin to segregate each group of parts.

22. INSPECTION, REPAIR, AND ASSEMBLY OF FLOAT CIRCUIT PARTS.

a. Float. Fuel enters the bowl through the needle seat valve, the level of which is controlled by the float setting. The float must not be loaded, damaged, or worn and the float lip must be smooth (resurface lip with emery cloth if necessary).

b. Needle and Seat Assembly. The needle and seat must be checked for wear. Figure 10 shows a good and a bad needle. Needles may be checked by sliding edge of thumb nail over the seating surface. A groove indicates wear, which has been caused by contact with the seat. Therefore, any wear on the needle indicates a correspondent amount of wear on the seat. Needles and

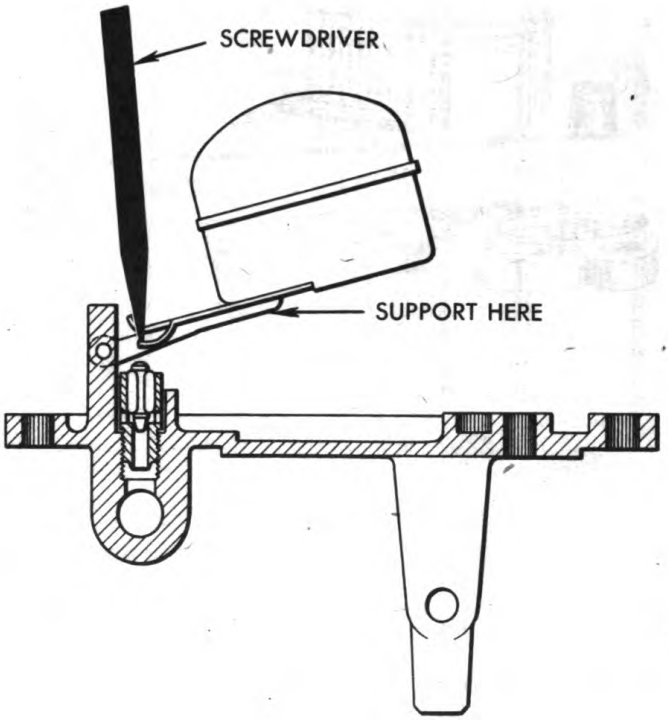


Figure 13 — Method of Adjusting Float Level

seats are obtainable only as matched sets. Never interchange a needle from one seat to another.

c. Assembly. Group all parts that control gasoline level, consisting of a float, pin, needle and seat, bowl cover, and bowl cover gasket. Install needle seat and gasket assembly. Install needle, float, and lever assembly, and float pin. Float pin may be checked for wear by sliding finger nail along pin in a manner similar to that recommended by checking the needle. Float pin hole in float must not indicate wear.

d. Float Adjustment. The correct method of checking the float level is shown in figure 12. Be sure that all adjustments are made by bending the float lip only (fig. 13). See specifications (fig. 17) at end of this chapter for correct setting.

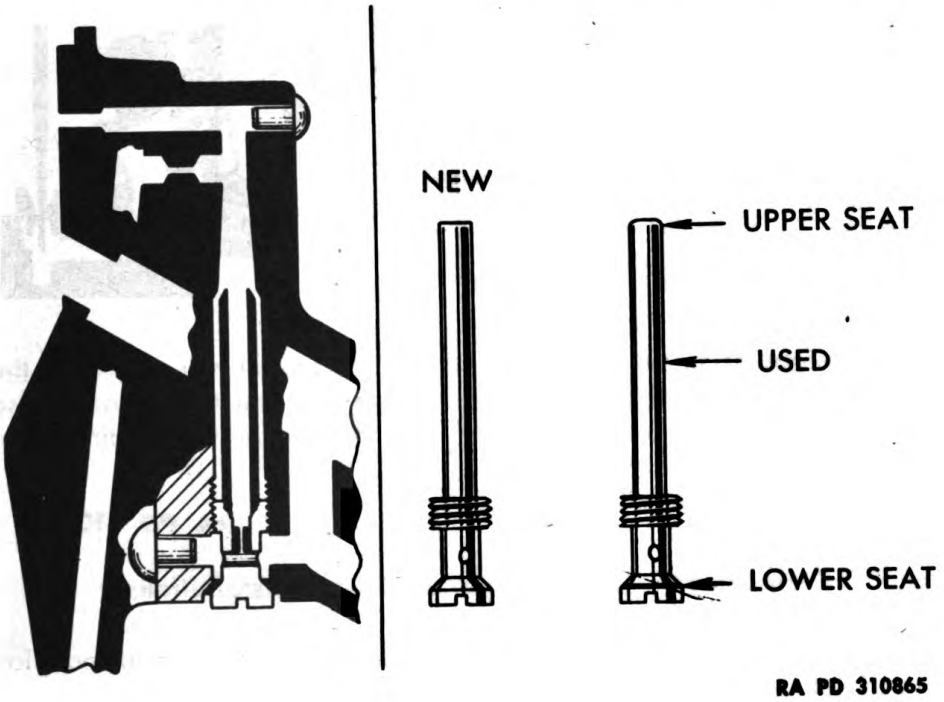
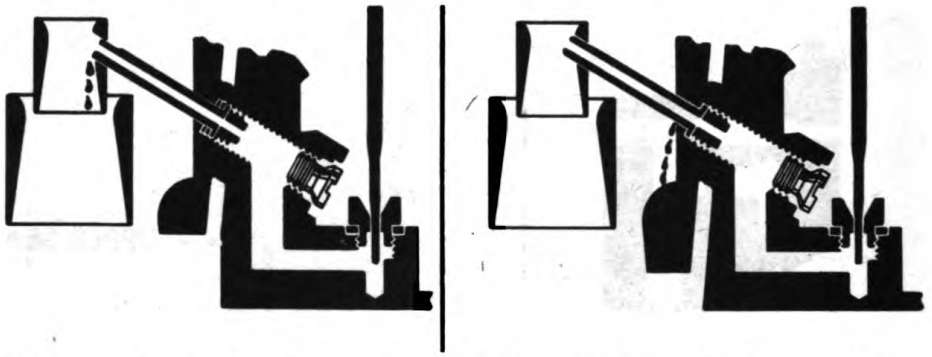


Figure 14 — Low Speed Jet

23. INSPECTION, REPAIR, AND ASSEMBLY OF LOW SPEED CIRCUIT PARTS.

a. Jet. When the low speed jet is once removed, it is doubtful whether or not a perfect seal can again be effected between the upper tip and body casting. When a new low speed jet is installed, the straight end is forced into a tapered seat in the casting, thus forming a seal. Figure 14 shows the shape of a new low speed jet and the casting seat. The illustration on the extreme right shows the shape of the jet after it has been used. It is important that the low speed jet be replaced with a new one if it is removed for any purpose. There is one copper gasket under the head of the low speed jet. Throttle valves should not show damage and must be installed with the stamped trademark facing the idle port and the mounting flange.

b. Assembly. Group all parts controlling low speed operation. This group consists of the low speed jet and gasket, idle adjusting screw and spring, idle port plug, throttle shaft, valve, and screws. Install throttle shaft and the throttle valve. Back out throttle lever adjusting screw. Small "c" in circle (©) or part number stamped on face of valve should be toward idle port and facing manifold side of flange. Center the throttle valve by pressing lightly with finger and tapping valve against bore before tightening screws. Install idle



With two gaskets under the nozzle, the effect is similar to a high float level and a mileage complaint may result. Always remove the old gasket before installing the new one.

With no gasket, a leak around the nozzle may result. The nozzle also is forced too far into the air stream.

RA PD 310866

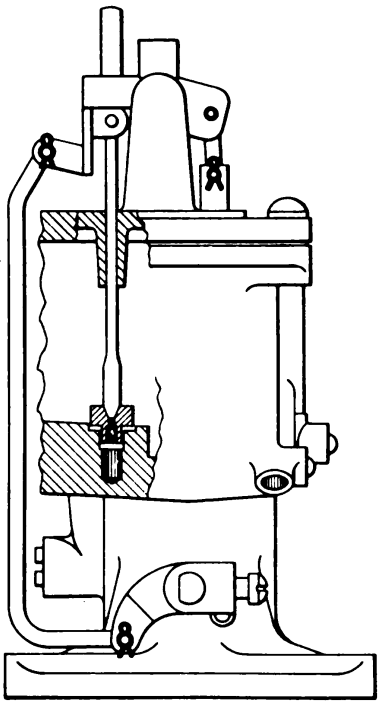
Figure 15 — Incorrect Nozzle Gasket Installations

adjustment screw and spring. Install idle port plug. Install new low speed jet. Be sure to install new copper washer in casting before installing jet. There should be no parts left in the parts pan (low speed group).

24. INSPECTION, REPAIR, AND ASSEMBLY OF PUMP CIRCUIT PARTS.

a. Inspection and Repair. It is advisable to soak plunger leathers for a short time before using, in leather dressing or a good grade of oil as leathers must be soft and pliable. The pump spring beneath the leather must be clean and not distorted. The plunger must be carefully inserted in the cylinder by means of a cylinder loading tool. A new pump cylinder gasket to seal the top of the pump cylinder must be installed each time the carburetor is assembled. The check valves and the pump jet must be clean and undamaged, and each of these parts must effect a seal in the casting. Test checks for free operation by blowing. The linkage must be free from backlash so that the pump plunger moves as soon as the throttle begins to open. Bent linkage generally indicates presence of dirt in the pump jet. The felt packing on the bowl cover countershaft should be lubricated with engine oil. CAUTION: *Other parts of the linkage must not be lubricated but should be kept clean.*

b. Assembly. Group all parts for pump circuit, including: plunger assembly, pump spring, pump connector link, intake and discharge checks, strainer, check passage plug and gasket, pump jet and pump jet plug, pump arm and collar assembly, felt washer, pump



RA PD 310867

Figure 16 — Use of Metering Rod Gage 41-G-234-55

cylinder bushing gasket (cork), and necessary retainers for pump link. Install pump jet and pump jet plug. Use new copper washer in casting before installing plug. Install pump discharge check and intake check. Insert strainer in check valve passage plug and place new copper washer in casting before installing plug. Then install pump spring and pump plunger assembly, using loading tool to avoid damage to plunger leather. Install the pump cylinder gasket in recessed portion of bowl cover.

25. INSPECTION, REPAIR, AND ASSEMBLY OF HIGH SPEED CIRCUIT PARTS.

a. Inspection and Repair. The nozzle must be clean, undamaged, and properly installed. A common error in carburetor service is to install the nozzle with either two nozzle gaskets, or no nozzle gasket at all. Either of these incorrect installations will result in unsatisfactory performance. Both possibilities are shown in figure 15. The nozzle fits into the small venturi with the flat side up. When properly inserted, the nozzle will be held stationary while the nozzle plug is tightened. The metering rod disk must be free on the metering rod to provide an effective air seat at the metering rod hole in the bowl cover. The metering rod spring must be hooked to the metering rod to hold it in a steady position in the metering rod jet.

CHEVROLET W-1 SPECIFICATIONS.

CARB. NUMBER	FLANGE NUMBER	MAIN VENTURI	FLOAT LEVEL	BOWL VENT	IDLE CIRCUIT BY-PASS	IDLE CIRCUIT ECONOMIZER	IDLE CIRCUIT BLEED	SET IDLE ADJ. SCREW	MET. ROD GAGE	MET. ROD	MET. ROD JET	LO. SP. JET	REPAIR PTS. PKG.	GASKET ASS'T
387[3]	329	1¼" I.D.	3/8"	INSIDE- #27 DRILL ABOVE CHOKE VALVE. #35 BELOW VALVE.	#56	.059"-.060"	#54	1-2 TURNS OPEN	T109-25	75-183	120-119[3]	11-147	1074[A]	—
391[3]	337	1¼" I.D.	3/8"	INSIDE- #27 DRILL ABOVE CHOKE VALVE. #35 BELOW VALVE.	#56	.059"-.060"	#54	1-2	T109-25	75-290	120-129[3]	11-138	1006[A]	129
420[3]	365	1¼" I.D.	1/2"	INSIDE- #27 DRILL ABOVE CHOKE VALVE. 3/16" BELOW VALVE.	#56	1939 .059"-.060" / 1940 .062"-.063"	#54	1-2	T109-25	75-377	120-129[3]	11-144	1013[B]	138[A]
434[3]	373	1 1/16" I.D.	1/2"	INSIDE- #27 DRILL ABOVE CHOKE VALVE. 3/16" BELOW VALVE.	#56	.051"-.053"	NONE	1-2	T109-25	75-381	120-49[3]	11-144	—	138[A]
483[3]	421	1¼" I.D.	1/2"	INSIDE	#51	.0545"-.0555"	NONE	1¼-2¼	T109-25	75-562	120-115[3]	11-173[3]	1336	174[A]
492[3]	432	1 1/16" I.D.	3/8"	INSIDE	#56	.0545"-.0555"	NONE	1¼-2¼	T109-25	75-508	120-49[3]	11-147	1091	138[A]
515[3]	421	1¼" I.D.	1/2"	INSIDE	#51	.0545"-.0555"	NONE	1¼-2¼	T109-25	75-562	120-115[3]	11-173[3]	1336	174[A]
518[3] 518[3A]	510	1¼" I.D.	3/8"	INSIDE- #27 DRILL ABOVE CHOKE VALVE. #35 BELOW VALVE.	#56	.059"-.060"	#54	1-2	T109-25	75-571	120-119[3]	11-147	1074[A]	138[A]
556[3]	492	1¼" I.D.	1/2"	INSIDE	#51	.0545"-.0555"	NONE	1-2	T109-25	75-562	120-129[3]	11-173[3]	1333[A]	174[A]
570[3]	421	1¼" I.D.	3/8"	INSIDE	#51	.0545"-.0555"	NONE	1¼-2¼	T109-25	75-562	120-115[3]	11-173[3]	1336	174[A]
574[3]	421	1¼" I.D.	1/2"	INSIDE	#51	.0545"-.0555"	NONE	1¼-2¼	T109-25	75-562	120-115[3]	11-173[3]	1336	174[A]

RA PD 310868

Figure 17 — Brief W-1 Specifications

b. Assembly. Group all parts controlling high speed circuit. These parts include: nozzle assembly, gasket, retainer plug, nozzle passage plug and gasket, metering rod and disk, metering rod jet, throttle connector rod, and throttle shaft lever. Install metering rod jet and gasket assembly. Install bowl cover assembly and bowl cover gasket. Install pump connector link. Install throttle shaft arm and throttle connector rod. At this time all high speed circuit parts have been installed except the nozzle assembly, gasket, retainer plug, nozzle passage plug and gasket.

c. Metering Rod Adjustment must be made when overhauling the carburetor or at definite service maintenance periods. The metering rod must be properly gaged, or delivery of fuel by the high speed circuit will be incorrect throughout its entire range. Procedure is as follows:

(1) Back out throttle stop screw in throttle lever until valve is fully closed.

(2) Open throttle and insert metering rod gage (41-G-234-55) in place of metering rod seating tapered end in metering rod jet (fig. 16).

(3) With throttle valve tightly closed and gage seated in metering rod jet, there should be less than 0.005-inch clearance between metering rod pin and shoulder of gage.

(4) To adjust, bend throttle connector rod at lower angle. Use slotted portion of tool 41-B-533 with grip handle and bar.

(5) Remove metering rod gage and install metering rod and disk. Connect the metering rod spring to the rod.

26. INSPECTION, REPAIR, AND ASSEMBLY OF CHOKE CIRCUIT PARTS.

a. Service Requirements. Service requirements of the choke circuit are as follows: Air horn and choke valve must be clean and undamaged, and the choke valve must not drag on the inner walls of the air horn. Carburetor air horns are frequently distorted because the air cleaner clamp has been installed too tightly. This tends to make the air horn out of round with the consequent result that the choke valve will drag against the inner walls. The choke valve spring must be installed correctly as the incorrect installation of this spring will probably result in hard starting.

b. Assembly. Group all parts controlling choke circuit, including: air horn, choke valve and screws, choke shaft and spring, and choke tube clamp. Install choke shaft and lever assembly and choke spring. Install choke valve, using new screws. Connect choke spring. Install nozzle and gasket, nozzle retainer plug, high speed passage plug and gasket (these parts could not be installed previously as nozzle extended into primary venturi of air horn).

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ORDNANCE MAINTENANCE — CARBURETORS (CARTER)

CHAPTER 4

TYPE W-1 CARBURETOR, MODEL 420S

Section I

DESCRIPTION

27. FLOAT CIRCUIT.

a. Function. The float circuit of the 420S carburetor is essentially the same as that described in chapter 3, the difference being in the bowl vent. Due to the fact that the bowl is vented through the choke shaft, this difference will be described fully in paragraph 31. The vent passage between the body casting and the bowl cover is sealed with the bowl cover gasket. Be sure gasket has the perforation shown (arrow) in upper left-hand corner of figure 22.

28. LOW SPEED CIRCUIT.

a. Function. The low speed circuit of the 420S carburetor differs from that described in chapter 3 in that just above the idle port, an additional small amount of air is admitted from the carburetor throat. It is known as the "idle air bleed." The circuit functions as follows: Fuel from the carburetor bowl is pushed through the calibrated hole in the low speed jet and flows into the low speed jet passage. At the top of this passage, air is admitted from the carburetor throat through the bypass hole. The fuel and air then pass through a restriction in the cross passage, called the economizer, and from this point the mixture flows down the passage terminating at the idle port and the idle adjustment screw hole. The idle bleed hole (just above the idle port) admits an additional amount of air before the mixture is discharged into the air stream. See figure 19. In operation the bulk of the idle circuit mixture is discharged from the idle port, an additional amount, adjusted to the engine's needs, is discharged from the idle adjustment screw hole. Turning the screw toward the seat decreases the volume of the mixture discharged and vice versa.

TYPE W-1, CARBURETOR, MODEL 420S

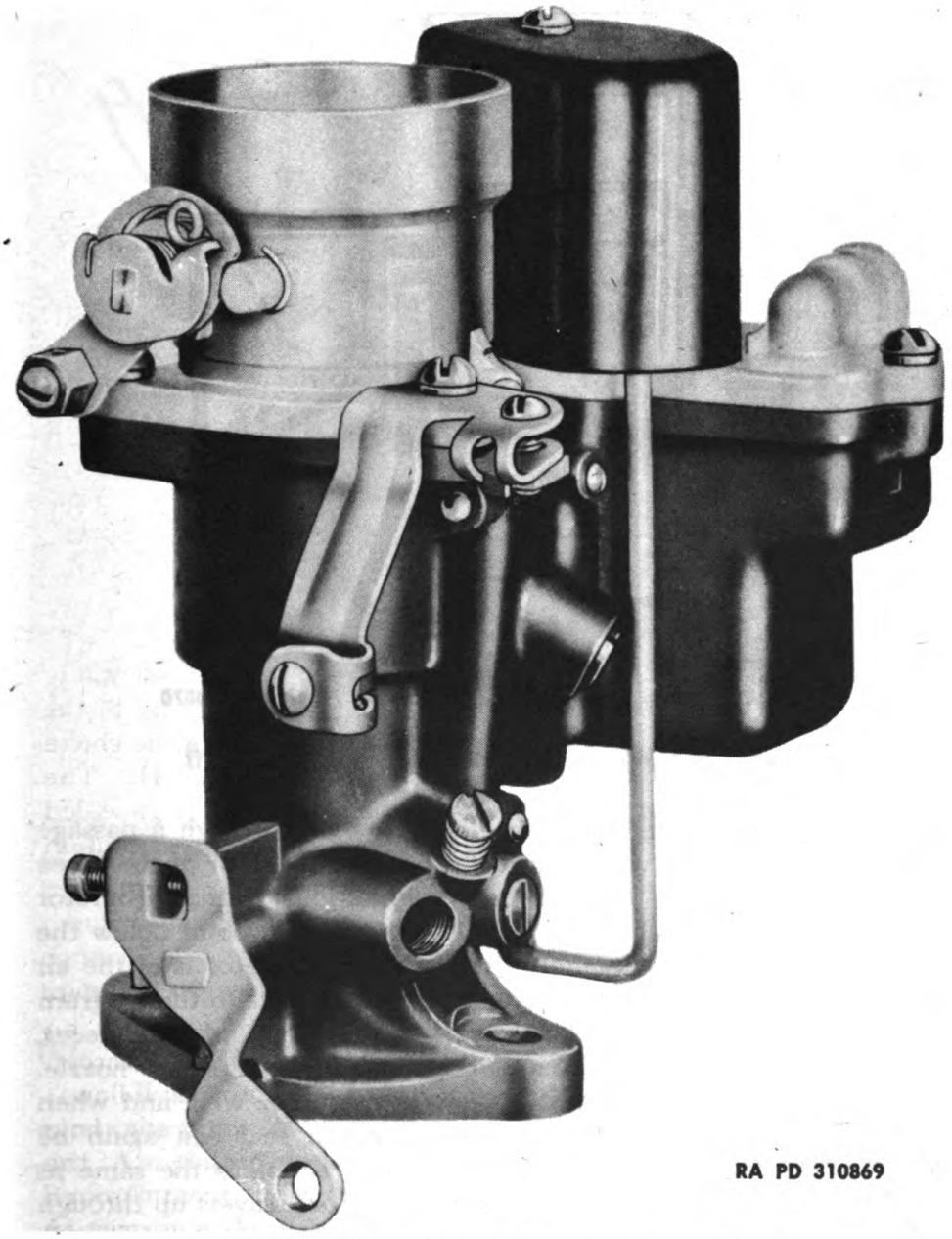


Figure 18 — W-1 Carburetor Model 420S

Hence, a leaner idle mixture is obtained by turning the idle adjustment screw in, and conversely, backing out the idle adjustment screw produces a richer idle mixture.

29. HIGH SPEED CIRCUIT.

a. Function. Fuel to this circuit is metered from the bowl through the calibrated orifice provided by the metering rod jet and the meter-

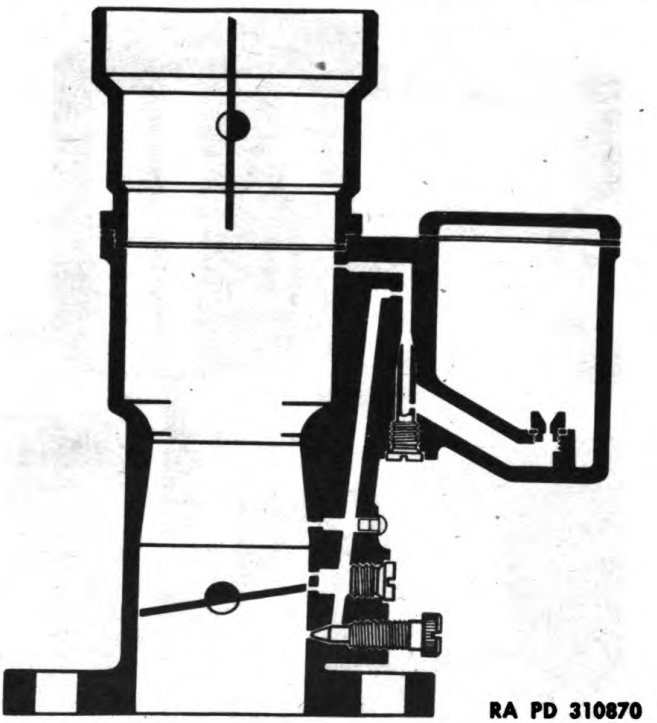


Figure 19 — W-1 Model 420S Low Speed Circuit

ing rod within it. From this point, the fuel flows through a passage to the nozzle assembly which produces into the smallest of the three venturi in the air horn. At idle, when the fuel level in the carburetor bowl is correct, the level of fuel in the nozzle is at a point below the nozzle tip. The nozzle assembly used in this carburetor is of the air bled type. This nozzle is illustrated in figure 20 next to the diagram of the high speed circuit. The nozzle unit consists of two pieces, the outer shell or slip nozzle, and the inner shell or screw nozzle. The upper tip of the inner nozzle seats in the outer well, and when once removed, it is doubtful whether or not a seal can again be effected if the parts are reused. The sealing action is the same as that of the low speed jet shown in figure 24. Fuel travels up through the inner nozzle. Around the annular space which exists between the outer and inner parts of the nozzle, a quantity of air is present. This air enters through the hole on the upper side of the slip nozzle; it then travels down toward the base of the nozzle assembly and mixes with the fuel. Air entering at this point assists in the atomization of the fuel. As the throttle valve is opened, the linkage raises the metering rod in the jet. The metering rod has several tapered steps machined on the lower end, and as it is raised in the jet, the effective size of the fuel orifice becomes greater. This permits more fuel to flow through the circuit to meet the load demand imposed

TYPE W-1, CARBURETOR, MODEL 420S

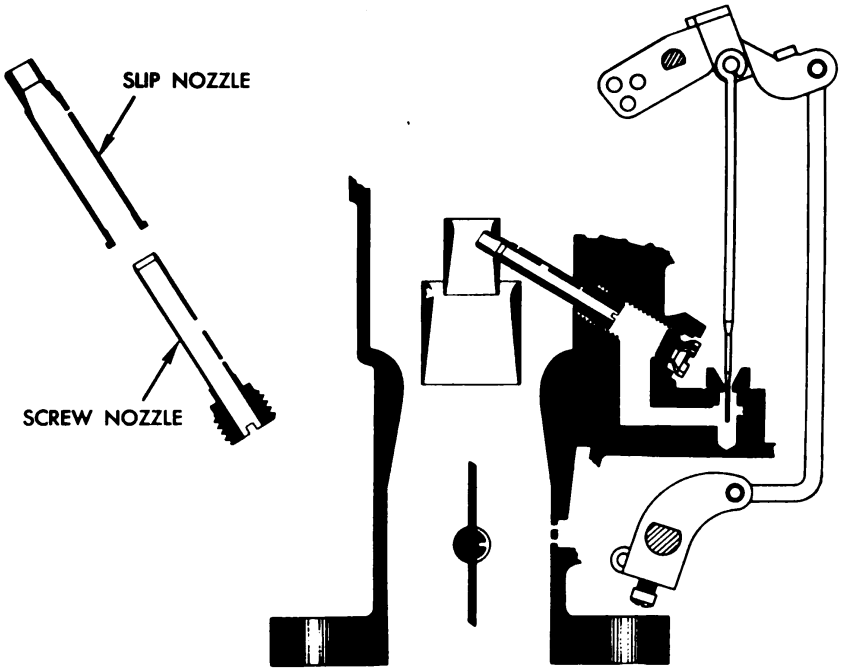


Figure 20 — W-1 Model 420S High Speed Circuit

upon the engine. At wide open throttle position, the smallest step of the metering rod is in the circular opening of the jet. This permits the maximum amount of fuel to flow through the circuit to meet the requirements of maximum power. The metering rod and jet, which control the flow of fuel for the high speed circuit, are machined to a tolerance of twenty-five hundred thousandths of an inch (0.00025 in.).

30. PUMP CIRCUIT.

a. Function (fig. 21). When the throttle is closed, the linkage raises the pump plunger assembly toward the top of the pump cylinder. On this stroke of the pump, a quantity of fuel from the bowl flows through the intake check valve and into the pump cylinder. At this time the discharge check valve is on its seat preventing air from entering through the pump jet. The check valves are protected from dirt by a suitable screen located directly beneath them. When the throttle is opened, the linkage forces the plunger down and the fuel beneath it is pushed out of the pump cylinder back to the check valve passage. The pressure of the fuel forces the intake check valve to its seat, thus preventing the return of the fuel to the bowl. The discharge check valve is forced off its seat and the fuel passes through it to the pump jet, where it is discharged in a finely metered stream. When the throttle is again closed, the pump cylinder is filled as before.

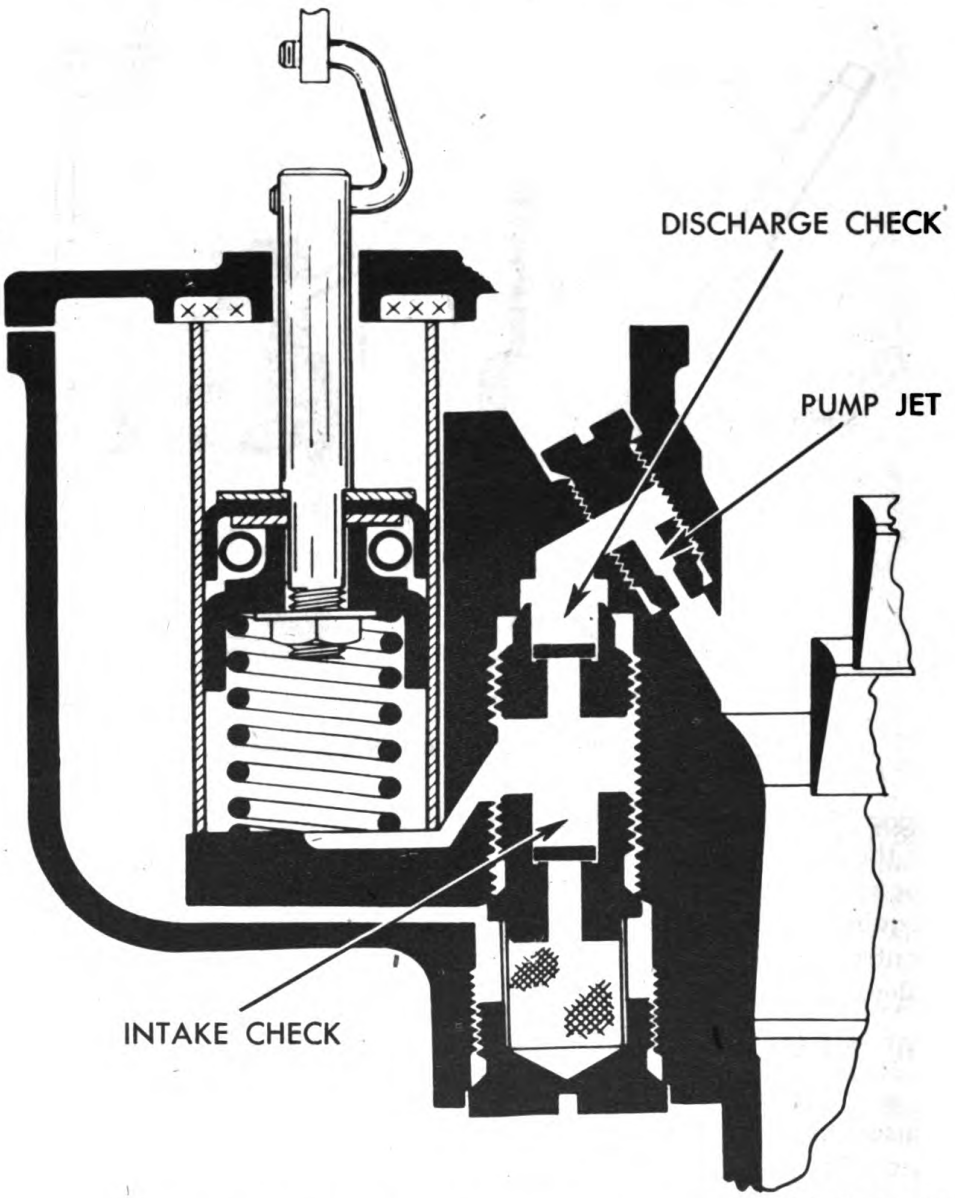


Figure 21 — W-1 Model 420S Pump Circuit

b. Delayed Action. The successful operation of the accelerating pump depends upon its "delayed action," which provides a continued stream of fuel from the pump jet, after the throttle has ceased moving. This is to take care of the fuel demands of the engine in the interval that exists between the time the throttle is opened and the time the high speed nozzle begins to discharge fuel. "Delayed action" may be achieved in several ways but this carburetor employs the following method, sometimes referred to as the "dry pump." Between the

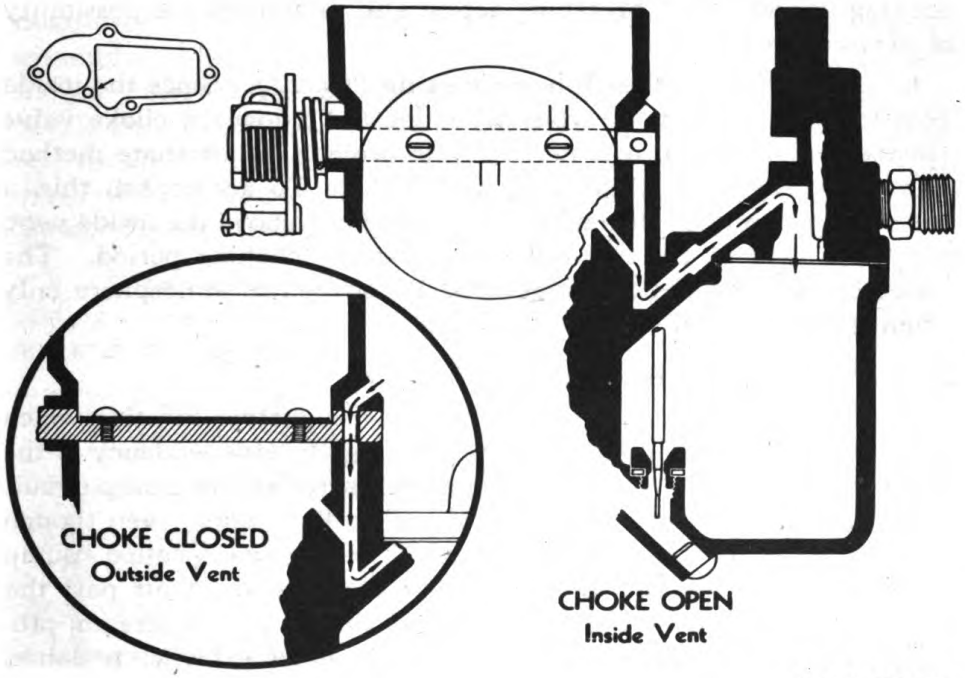


Figure 22 — Method of Providing Temporary Outside Vent to Bowl when Choking

plunger leather and the fuel, a pocket of air is maintained in the plunger cup. When the plunger is pushed down, it compresses this air, and the compressed air in turn forces the fuel from the pump cylinder. At the end of the plunger stroke, the compressed air expands, providing the necessary force to continue the fuel discharge. The hole in the intake check is small; therefore, the incoming fuel enters the pump cylinder slowly. In the event that some of the air below the pump plunger has been absorbed by the gasoline, a small amount of air escapes downward past the plunger leather, and in this way replenishes the supply of air in the pump cylinder necessary for delayed action. It must be remembered that this action does not take place on every stroke of the pump, but occurs only when a substantial portion of the pocket of air has been lost.

31. CHOKE CIRCUIT.

a. Function. When the choke is used, the mixture is enriched by cutting down the amount of air admitted through the carburetor. This carburetor uses a choke with a semi-automatic feature which is brought about by operation through a coiled spring on the end of the choke shaft. This spring action, combined with an off-center choke valve, enables the valve to breathe with the engine during the

choking period. This breathing action also minimizes the possibility of over-choking.

b. Bowl Vent Action When Choking (fig. 22). Since the inside vent to the bowl in this carburetor is located below the choke valve (inside the air horn), it is necessary to provide an alternate method of venting the bowl while using the choke. To accomplish this, a cross drilling through the end of the choke shaft above the inside vent, permits a vent to the atmosphere during the choking period. The inside or balanced vent passage must be opened to atmosphere only when the choke is in the "ON" position.

32. INTERDEPENDENCY OF CIRCUITS.

a. The pump circuit in this carburetor has another function which was mentioned previously under the heading "Interdependency of the Carburetor Circuits." As the engine speed increases, the pump circuit delivers a small metered quantity of fuel to the engine, even though the throttle is held in a fixed position. This feature is called "pump bleed." It has been shown before that the passage of air past the tip of a jet will enable this jet to deliver fuel to the air stream, provided the jet is connected to a fuel source under a higher pressure. This is the condition existing in this carburetor. Air passes down through the air horn past the lower end of the pump jet passage, which is connected to the carburetor bowl through the check valve passage. From part throttle to wide open throttle, fuel from the carburetor bowl is pushed through the check valves and out the pump jet. This fuel is a definite part of the engine's demand and is an essential part of the carburetor calibration. In order to insure the uninterrupted flow of fuel at the required time, disk check valves of light weight are employed in this carburetor. They should never be replaced with check valves of any other type. "Pump bleed" is a built-in feature of this carburetor and when the unit has been properly serviced with the correct parts, this feature will automatically take care of itself. Under no conditions should a service man attempt to alter this feature. Whether or not a carburetor employs "pump bleed" is a prime concern of the design engineer.

Section II

DISASSEMBLY

33. DISASSEMBLY.

a. Remove and Disassemble Bowl Cover. Disconnect throttle connector rod at pump arm, then remove bowl cover attaching screws and lift bowl cover with all parts attached. Remove metering rod,

float, needle and seat, pump link and plunger, pump arm and collar assembly. The nozzle assembly extends into the primary venturi of the air horn. Therefore, it is necessary to remove both the screw nozzle and the slip nozzle before the air horn can be removed. Then remove air horn attaching screws and lift off air horn assembly. Remove choke valve attaching screws and slide choke shaft from air horn. Do not damage choke spring when removing shaft.

b. Disassemble Body Casting. Removal of parts from the body casting can be effected with a minimum change of sizes of screw drivers and shifting of casting if performed in the following sequence:

(1) Pump jet plug and pump jet.

(2) Metering rod jet.

(3) Idle adjusting screw and spring.

(4) Idle port plug.

(5) Check valve passage plug, strainer, intake and discharge check valves.

(6) Low speed jet.

(7) Throttle shaft arm and throttle connector rod.

(8) Throttle valve, throttle shaft and lever assembly.

Section III

CLEANING, INSPECTION, REPAIR, AND ASSEMBLY

34. CLEANING AND INITIAL INSPECTION.

a. Body Casting. The idle passages, the idle bypass and idle bleed holes, and the economizer in the casting must be absolutely clean. Soak the casting for a short time in dry-cleaning solvent or any approved cleaner (SNL K1), then blow out with compressed air. The carburetor bore must be free from carbon deposit around the throttle valve. This carbon deposit to which all carburetors are subjected after

prolonged low speed operation, is usually overlooked by the untrained carburetor service man, and no one cause will contribute as much to a rich idle as this deposit.

b. Air Horn and Bowl Cover. Soak parts in dry-cleaning solvent and blow out with compressed air. Inspect air horn for "out of round," dents in venturis, and wear in choke shaft bearings. Check bowl cover for warpage.

c. A wire basket usually facilitates the cleaning of the small parts. Parts which are to be replaced, such as low speed jet, gaskets, etc., need not be cleaned. When carburetor is completely overhauled, the installation of a repair parts package is recommended. For list of parts in this package see paragraph 20 **c.**

d. Inspection of Major Parts. After body casting has been cleaned as recommended in paragraph 20 **a**, the following inspection should be made:

(1) Be sure that nozzle gasket has been removed from high speed passage.

(2) All carbon accumulation in the bore of the carburetor has been removed.

(3) All passages are clear of carbon and dirt.

(4) Idle port has not been damaged.

(5) Idle bleed hole (in bore just above idle port) must be clean and undamaged.

(6) All shoulders for seats of check valves, low speed jet, nozzle, and screw plugs have not been damaged.

(7) If bottom of float bowl shows rust, indicating presence of water, remove all rust with wire brush and paint inside of bowl with a good grade of auto body lacquer.

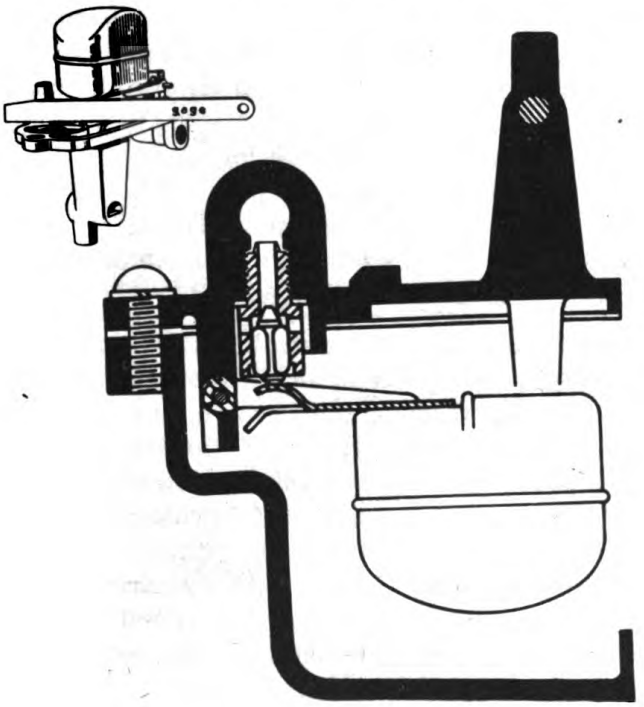
35. CIRCUIT SERVICE METHOD.

a. The overhauling of carburetors by the Circuit Service Method is the fastest simple method. By grouping the parts and the installation of such parts in groups, it will usually be found that each group can be installed as a unit before proceeding to the next group. It will be necessary to divert from this system when installing only one or two parts. It is suggested that the service man use a sectionalized pan or muffin tin to segregate each group of parts.

36. INSPECTION, REPAIR, AND ASSEMBLY OF FLOAT CIRCUIT PARTS.

a. Float. Fuel enters the bowl through the needle seat and valve. The level is controlled by the float setting. The float must not be loaded, damaged or worn. The float lip must be smooth; resurface with emery cloth if necessary.

TYPE W-1, CARBURETOR, MODEL 420S



RA PD 310874

Figure 23 — W-1 Model 420S Float Circuit

b. Needle and Seat Assembly. The needle and seat must be checked for wear. Figure 11 shows a good and a bad needle. Needles may be checked by sliding edge of thumb nail over the seating surface. A groove indicates wear, which has been caused by contact with the seat. Therefore, any wear on the needle indicates a correspondent amount of wear on the seat. Needles and seats are obtainable only as matched sets. Never interchange a needle from one seat to another.

c. Assembly. Group all parts that control gasoline level, consisting of float, pin, needle and seat, bowl cover, and bowl cover gasket. Install needle seat and gasket assembly. Install needle, float and lever assembly and float pin. Float pin may be checked for wear by sliding fingernail along pin in a manner similar to that recommended for checking the needle. Float pin hole in float must not indicate wear.

d. Float Adjustment. The correct method of checking the float lever is shown in figure 23. Be sure that all adjustments are made by bending the float lip only. See specifications figure 17 for proper setting.

37. INSPECTION, REPAIR, AND ASSEMBLY OF LOW SPEED CIRCUIT PARTS.

a. Jet. When the low speed jet is once removed, it is doubtful whether or not a perfect seal can again be effected between the upper

tip and body casting. When a new low speed jet is installed, the straight end is forced into a tapered seat in the casting, this forms a seal. Figure 24 shows the shape of a new low speed jet and the casting seat. The illustration on the extreme right shows the shape of the jet after it has been used. It is important that the low speed jet be replaced with a new one if it is removed for any purpose. There is one copper gasket under the head of the low speed jet. Throttle valves should not show damage and must be installed with the stamped trademark facing the idle port and the mounting flange.

b. Assembly. Group all parts controlling low speed operation. This group consists of the low speed jet and gasket, idle adjusting screw and spring, idle port plug, throttle shaft, valve, and screws. Install throttle shaft and throttle valve. Back out throttle lever adjusting screw. Small "c" in circle "©" or part number stamped on face of valve should be toward idle port and facing manifold side of flange. Center throttle valve by pressing lightly with finger and tapping valve against bore before tightening screws. Install idle adjustment screw and spring. Install idle port plug. Install new low speed jet. Be sure to install new copper washer in casting before installing jet. There should be no parts left in the parts pan (low speed group).

38. INSPECTION, REPAIR, AND ASSEMBLY OF PUMP CIRCUIT PARTS.

a. Service Requirements. The plunger leather must be soft and pliable, and undamaged. It is advisable to soak plunger for a short time before using, in leather dressing or a good grade of oil. The pump spring beneath the leather must be clean and not distorted. The plunger must be carefully inserted in cylinder by means of a cylinder loading tool. A new pump cylinder gasket, to seal the top of the pump cylinder, must be installed each time the carburetor is assembled. The check valves and the pump jet must be clean and undamaged, and each of these parts must effect a seal in the casting. Test checks by blowing for free operation. The linkage must be free from backlash so that the pump plunger moves as soon as the throttle begins to open. Bent linkage generally indicates presence of dirt in the pump jet. The countershaft in the bowl cover should be lubricated with graphite grease through the dust cover screw hole. CAUTION: *The other parts of the linkage must not be lubricated but should be kept clean.*

b. Assembly. Group all parts for pump circuit, including: plunger assembly, pump spring, pump connector link, intake and discharge checks, strainer, check passage plug and gasket, pump jet and pump jet plug, pump arm and countershaft assembly. Install pump jet and pump jet plug. Use new copper washer in casting before installing plug. Install pump discharge check and intake check. Insert strainer

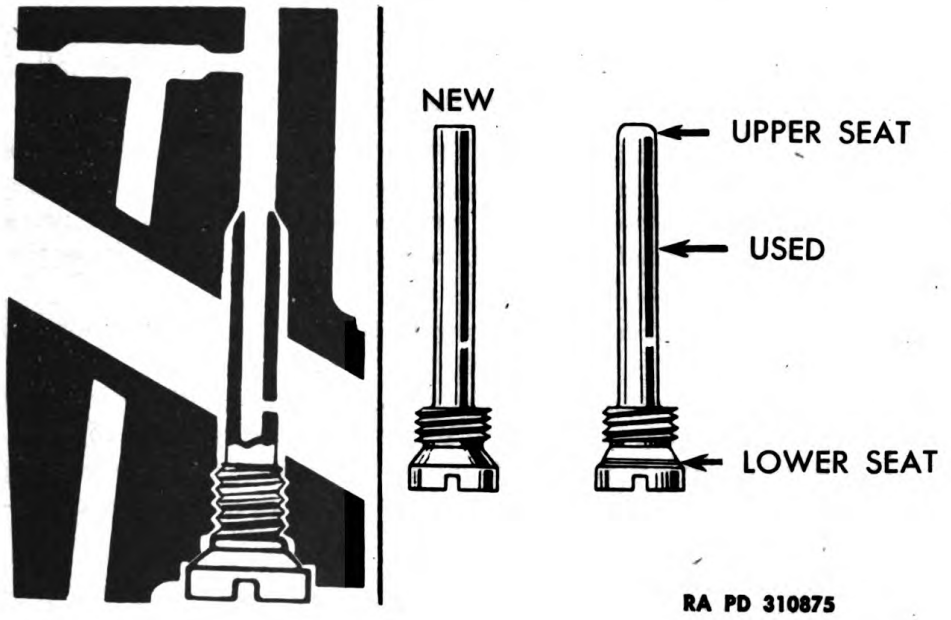


Figure 24 — W-1 Model 420S Low Speed Jet

in check valve passage plug and place new copper washer in casting before installing plug. Then install pump spring and pump plunger assembly, using loading tool to avoid damage to plunger leather. Install the pump cylinder gasket in recessed portion of bowl cover and also install pump arm and countershaft assembly in bowl cover.

39. INSPECTION, REPAIR, AND ASSEMBLY OF HIGH SPEED CIRCUIT PARTS.

a. Service Requirements. The nozzles must be clean, undamaged, and properly installed. A common error in carburetor service is to install the slip nozzle with either two nozzle gaskets, or with no nozzle gasket at all. Either of these incorrect installations will result in unsatisfactory performance. Both possibilities are shown in figure 15. The outer nozzle fits into the small venturi with the flat side up. When properly inserted, it will be held stationary while the inner nozzle is installed. The metering rod disk must be free on the metering rod to provide an effective air seal at the metering rod hole in the bowl cover. The metering rod spring must be hooked to the metering rod to hold it in a steady position in the metering rod jet.

b. Assembly. Group all parts controlling the high speed circuit. These parts include: outer shell or slip nozzle, inner shell or screw nozzle, nozzle gasket, passage plug and gasket, metering rod and disk, metering rod jet, throttle connector rod, and throttle shaft lever. Install

metering rod jet and gasket assembly. Install bowl cover assembly and bowl cover gasket. Install throttle shaft arm and throttle connector rod. At this time all high speed circuit parts have been installed except the nozzles, gasket, passage plug and gasket.

c. Metering Rod Adjustment. Metering rod adjustment must be made when overhauling the carburetor or at definite service maintenance periods. The metering rod must be properly gaged or delivery of fuel by the high speed circuit will be incorrect throughout its entire range. Procedure is as follows:

(1) Back out throttle stop screw in throttle lever until valve is fully closed.

(2) Open throttle and insert metering rod gage T109-25 in place of metering rod seating tapered end in metering rod jet (fig. 16).

(3) With throttle valve tightly closed and gage seated in metering rod jet, there should be less than 0.005-inch clearance between metering rod pin and shoulder of gage.

(4) To adjust, bend throttle connector rod at lower angle.

(5) Remove metering rod gage and install metering rod and disk. Do not forget to connect the metering rod spring to rod.

40. INSPECTION, REPAIR, AND ASSEMBLY OF CHOKE CIRCUIT PARTS.

a. Service Requirements. The air horn and choke valve must be clean and undamaged, and the choke valve must not drag on the inner walls of the air horn. Frequently, carburetor air horns are distorted because the air cleaner clamp has been installed too tightly. This tends to make the air horn out of round with the consequent result that the choke valve will drag against the inner wall. The choke valve spring must be installed correctly as the incorrect installation of this spring will probably result in difficult starting. Do not fail to install bowl vent passage gasket between air horn and body casting. The omission of this gasket will allow atmosphere to the bowl, which will result in a rich mixture through the entire high speed range. Be sure that bowl vent passage through air horn and choke shaft is not restricted.

b. Assembly. Group all parts controlling choke circuit, including: air horn, choke valve and screws, choke shaft assembly, spring, and choke tube clamp, and bowl vent passage gasket. Install choke shaft and spring. Install choke valve, using new screws. Connect choke spring. Install slip nozzle and gasket. CAUTION: *The slip nozzle tip fits into the small venturi with the flat side up. When properly inserted, the slip nozzle will be held stationary while the screw nozzle is tightened. Always use a new set of nozzles to insure an effective seal at the upper tip of the screw nozzle.* Install passage plug and gasket.

CHAPTER 5

TYPE W-0 CARBURETOR, MODELS 450S AND 539S

Section I

DESCRIPTION

41. FLOAT CIRCUIT.

a. Function. As the fuel rises in the bowl, the float closes the needle valve and prevents further entry of fuel, the level of which is controlled by the setting of the float. The needle and seat assembly used in these carburetors differs from the conventional type and is illustrated in figure 25. The needle is hollow for a considerable portion of its length and a spring and pin is inserted in it. When assembled in the carburetor, the lip of the float bears directly on the spring-loaded pin in the needle. Under the condition of vibration that may exist in small engines with live engine mountings, this device provides a better control of the level of fuel in the bowl. These carburetors use an outside bowl vent located beneath the counter shaft pin in the bowl cover.

42. LOW SPEED CIRCUIT.

a. Function. In most carburetors, the fuel must first pass through the main metering jet to get to the low speed circuit. However, this is not the case in the W-0 carburetor. Fuel from the bowl flows directly to the low speed circuit through the calibrated idle well jet, the passage of which enters the bowl adjacent to the metering rod jet. This feature causes the circuit to be termed "independent" or "isolated". Adjacent to the bowl is the idle well passage, in which the low speed jet is installed. Fuel from the bowl flows through the idle well jet to the well where it is pushed through the calibrated orifice in the low speed jet and up into the low speed passage. Here air is admitted from the carburetor throat through the bypass hole, and the resulting mixture of fuel and air pass through the economizer, a restriction in the cross passage. An additional amount of air enters the passage at this point, through the idle bleed hole, and the mixture flows down the passage terminating at the idle port and idle adjusting screw holes. In operation, the bulk of the idle circuit mixture is discharged from the idle port. An additional amount, adjusted to the engine's needs, is dis-

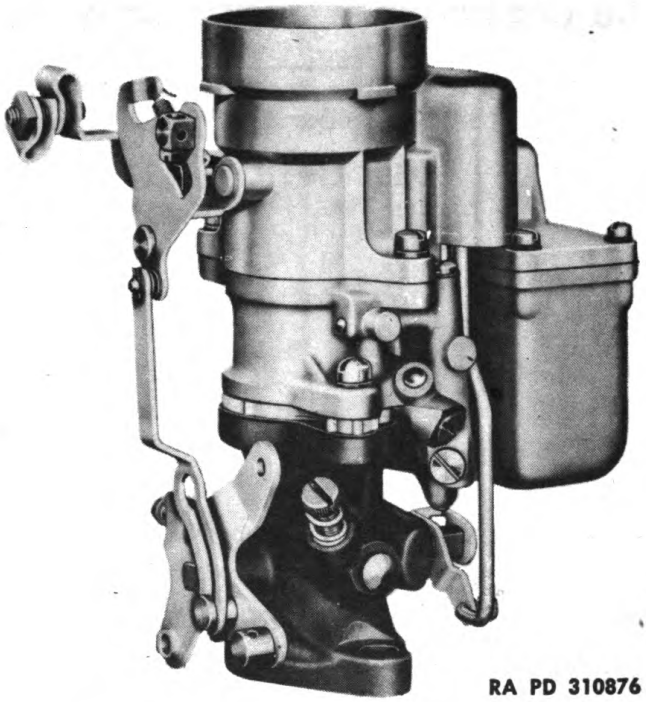


Figure 25 — Typical W-0 Carburetor

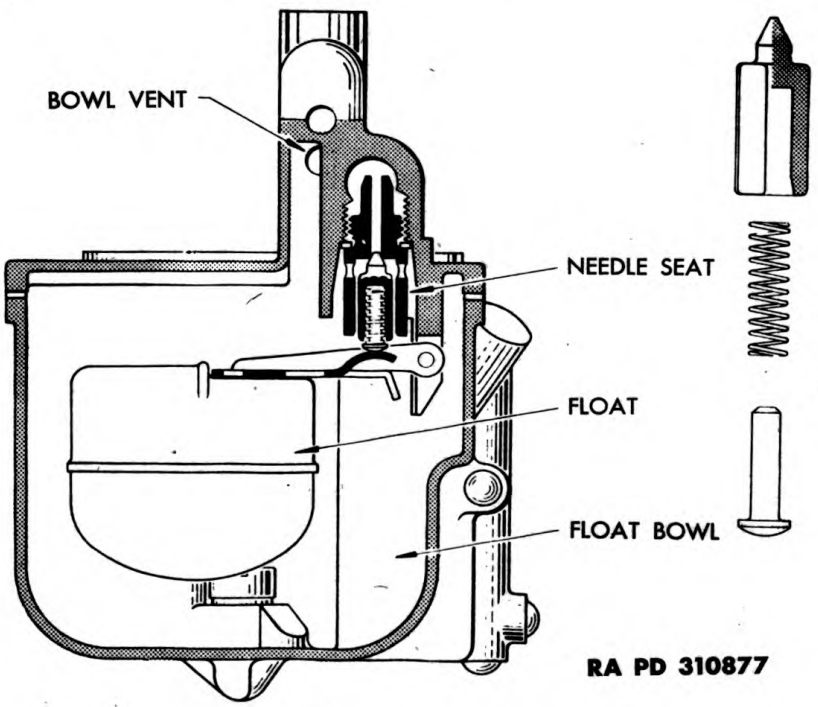


Figure 26 — W-0 Float Circuit

charged through the idle adjustment screw hole. Turning the screw toward the seat decreases the volume of the mixture discharged and vice versa. A leaner idle mixture is obtained by turning the idle adjustment screw in, and conversely backing out the idle adjusting screw will produce a richer idle mixture.

b. Idle Well Vent in 450S. The idle well is vented to the carburetor bowl in the 450S carburetor by means of a passage at the top of the well. Gasoline flows from the bowl to the idle well through the idle well jet by the force of gravity. Thus when the demands of the idle circuit are greater than the fuel flowing through the idle well jet, the balance of the demand is met by admitting air through the idle well vent. This well vent passage is not included in the 539S carburetor. Consequently, only gasoline is admitted to the low speed jet.

c. Idle Well Jet. Inasmuch as there is no connection between the low speed circuit and the high speed circuit, the low speed circuit delivers gasoline throughout the entire range, even at wide open throttle. The purpose of the idle well jet is two-fold:

(1) At part throttle and higher speeds, it aids in the metering of the fuel from the low speed circuit, however, it does not meter the fuel during idle operation.

(2) On bumpy ground where the vehicle has tremendous side sway, the idle well jet prevents gasoline from readily draining out of the idle well, thus assuring constant idle operation regardless of terrain.

43. HIGH SPEED CIRCUIT.

a. Function. Fuel from the bowl is metered to this circuit through the calibrated orifice provided by the metering rod jet and the metering rod within it. From this point, the fuel is conducted through a passage to the nozzle, extending into the small venturi. This nozzle is called the "flush type" as the upper tip of the nozzle is flush with the inner wall of the venturi. When the fuel level of the carburetor bowl is correct, the level of the fuel in the nozzle is at a point just below the lower lip. As the throttle valve is opened, the linkage raises the metering rod in the jet. The metering rod has several steps or tapers machined on the lower end, and as it is raised in the jet, it makes the effective size of the fuel orifice greater, thus permitting more fuel to flow through the circuit to meet the load demand imposed upon the engine. At wide open throttle position, the smallest step of the metering rod is in the circular opening of the jet, thus permitting the maximum amount of fuel to flow through the circuit to meet the requirements of maximum power.

b. Metering Rod Seat. On the 539S carburetor, the metering rod seats in the metering rod jet when the throttle is closed (idle position).

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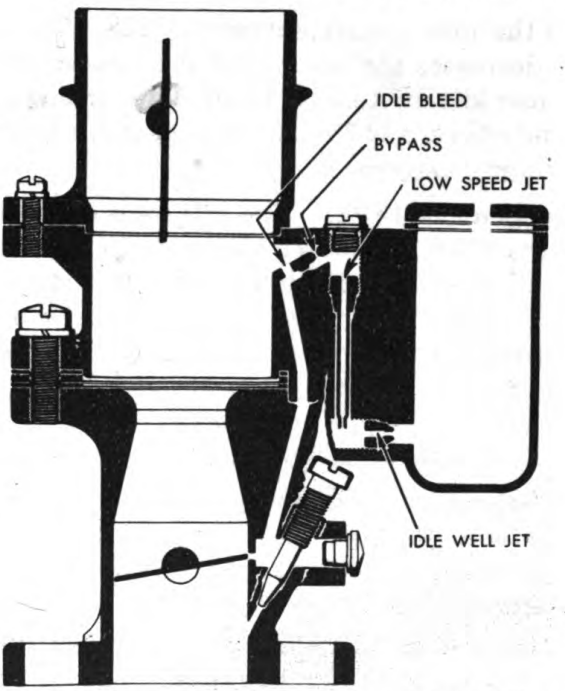

Figure 27 — W-0 Low Speed Circuit

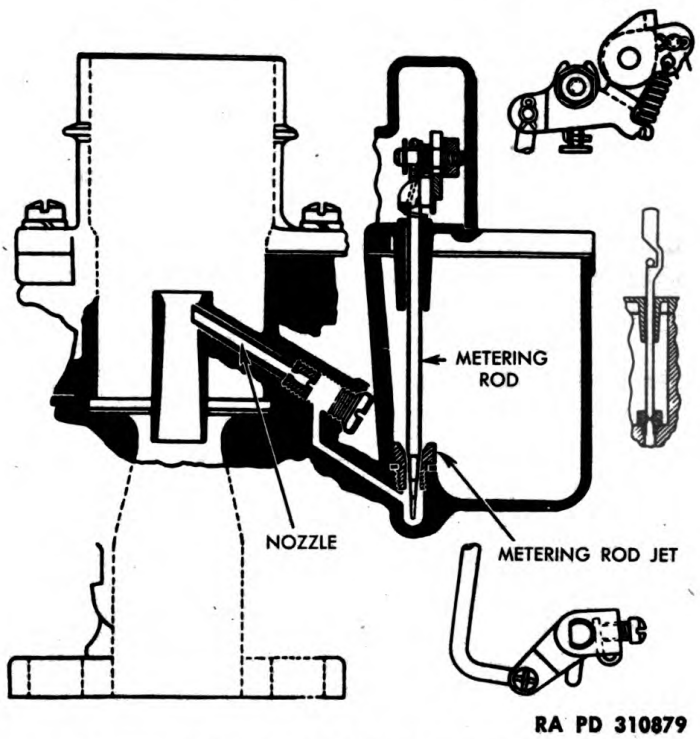

Figure 28 — W-0 High Speed Circuit

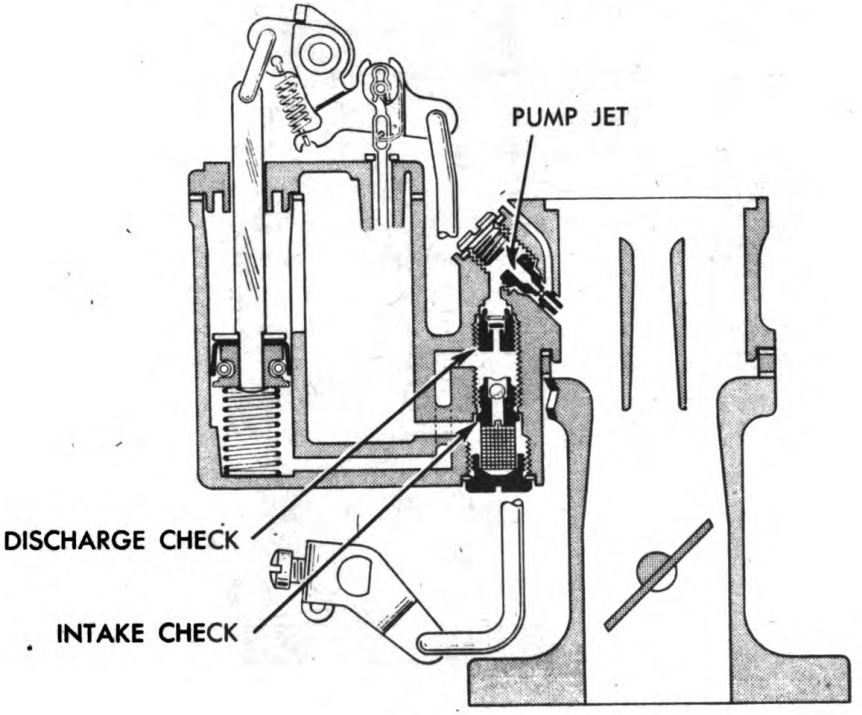

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Figure 29 — W-0 Pump Circuit

This is done to prevent fuel from the bowl spilling over the nozzle and stalling the engine when the vehicle is operated at extreme angles on rough terrain. To insure the seating of the metering rod in the jet, the metering rod eye is elongated, and the metering rod spring which is hooked through the rod rather than around it, exerts a downward pressure on the rod. The fact that at idle position, the metering rod seats in the jet, effectively preventing gasoline from entering the high speed passage, necessitates the use of the isolated low speed circuit in this carburetor.

44. PUMP CIRCUIT.

a. Function. As the throttle is closed, the linkage raises the plunger toward the top of the pump cylinder. On this stroke of the pump, a quantity of fuel from the bowl flows through the intake ball check into the pump cylinder. At this time the discharge check is on its seat preventing air from entering the pump circuit through the pump jet. The check assemblies are protected from dirt by a suitable strainer located directly beneath them. When the throttle is opened, the plunger is forced downward and the fuel beneath it is pushed out of the pump cylinder back to the check valve passage. The pressure of the fuel forces the intake ball check to its seat, thus preventing the return of the fuel to the bowl. The discharge disk check, which is just above it,

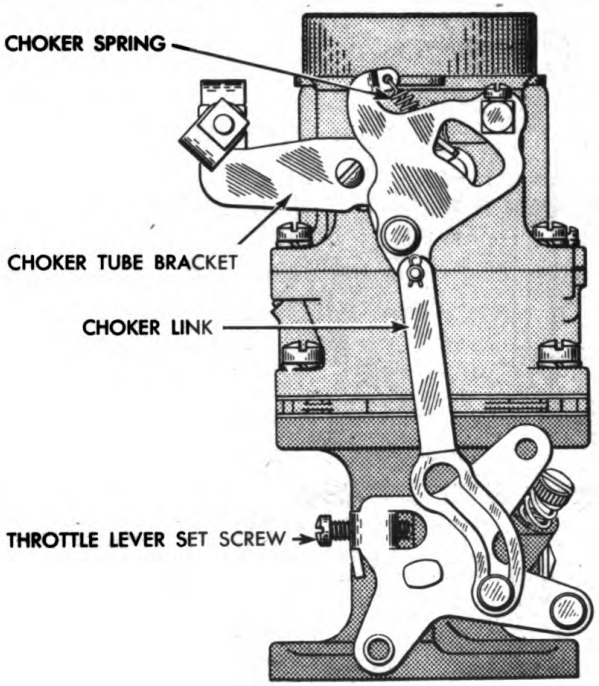

Figure 30 — W-0 Choke Circuit

is forced off its seat and the fuel passes through it to the pump jet where it is discharged in a finely metered stream. When the throttle is closed again, the pump cylinder is filled as before.

b. Delayed Action. It is necessary to provide a delayed action for the discharge of fuel from the pump circuit. This action is achieved in the W-0 carburetor by the pump arm spring. This spring connects the pump arm and collar assembly to the pump operating lever. Therefore, when the throttle is opened, the linkage drives the pump plunger through the pump arm spring. This provides a continued discharge from the pump circuit over the necessary time interval.

c. Pump Jet Relief Vent Hole. In the pump circuit of these carburetors "pump bleed" is not allowed to occur. "Pump Bleed" is the term used to describe the delivery of fuel from the pump jet during constant throttle operation (par. 12). In the W-O carburetors, the discharge end of the pump jet is extended; both ends of the pump jet have shoulders which seat in the casting. A small hole, from the outside of the casting, vents a cross-drilling in the jet between the two seating surfaces. This vent to atmosphere destroys the low pressure effect at the pump jet and hence no fuel can bleed from the pump circuit during constant throttle operation (fig. 28).

TYPE W-0 CARBURETOR, MODELS 450S AND 539S

45. CHOKE CIRCUIT.

a. Function. These carburetors employ a manual type choker illustrated in figure 29. When the choker is used, the mixture is enriched by cutting down the amount of air admitted through the carburetor. These carburetors use a choker valve with a semi-automatic feature, the choker is connected to the operating lever by a soft spring, the choker valve is also mounted off-center in the air horn. The incoming air tends to push the choker valve open (the longer section of the choker valve being on the lower side of the choker shaft), and the spring action tends to hold choker valve closed. Thus the valve is allowed to "breathe" with the engine, which tends to lessen the sensitivity of the choker control. In addition to this feature, a poppet valve is provided in the valve to allow inward relief and hence lessen the danger of over-choking when the engine starts to run. The choker and throttle levers are connected by the choker link, which opens the throttle slightly during the choking period.

Section II

DISASSEMBLY

46. DISASSEMBLY.

a. Remove and Disassemble Air Horn. Remove choker connector link, pin and spring. Remove choker valve attaching screws and slide choker shaft from air horn. Do not damage choker spring when removing shaft.

b. Remove and Disassemble Bowl Cover. Remove throttle shaft arm and throttle connector rod. Remove bowl cover as assembled, and pump plunger spring from cylinder in body casting. Disconnect metering rod spring and remove metering rod and disk. Remove pump plunger and link and slide metering rod arm assembly from countershaft. Remove float, pin, needle seat assembly, and bowl cover gasket.

c. Remove and Disassemble Throttle Body. Disassemble flange from body and remove insulator and gasket. Remove idle adjusting screw and spring. Remove throttle valve and slide throttle shaft from casting.

d. Disassemble Body Casting. Removal of parts from the body

casting can be effected with a minimum change of sizes of screw drivers and shifting of casting if performed in the following sequence:

(1) Remove low speed jet plug and low speed jet.

(2) Remove pump jet and pump jet passage plug.

(3) Remove idle well plug and idle well jet.

(4) Remove nozzle passage plug, nozzle retainer plug, and nozzle. (To remove nozzle, use puller (41-P-2951-10)).

(5) Remove metering rod jet and gasket assembly.

(6) Remove check passage plug, strainer, intake and discharge check assemblies.

Section III

CLEANING, INSPECTION, REPAIR, AND ASSEMBLY

47. CLEANING AND INITIAL INSPECTION.

a. Body Casting. Soak the casting for a short time in dry-cleaning solvent, then blow out with compressed air. All passages must be clean. Note particularly that the idle bypass, idle bleed and pump relief vent holes are clean and undamaged.

b. Throttle Body. The bore must be free from carbon deposit at the throttle valve. All carburetors are subject to this deposit after prolonged low speed operation and the use of wet or dry sandpaper aids greatly in removing it from the bore. Blow out all passages with compressed air.

c. Air Horn and Bowl Cover. Soak these parts in cleaner and blow out with compressed air. Check air horn for out of round and wear in choke shaft bearing. Check bowl cover for warpage and wear on countershaft.

d. Small Parts. Soak small parts in cleaner and dry them with compressed air. Parts which are to be replaced, such as low speed

jet, gaskets, etc., need not be cleaned. When the carburetor is completely overhauled, the installation of a repair parts package is recommended and includes the following parts: low speed jet, nozzle and retainer plug, needle seat assembly, idle well jet, pump jet, metering rod and jet, throttle shaft arm assembly, throttle connector rod, intake check, discharge check, pump link, metering rod disk, pump check strainer, all necessary gaskets, springs, plugs, screws, and retainers for complete rebuilding.

e. Inspection of Major Parts. After body casting has been cleaned (as described in subparagraph "a"), the following inspections should be made:

(1) Be sure that old nozzle gasket has been removed from high speed passage.

(2) Be sure that all passages are clear of carbon and dirt.

(3) Check all shoulders for seats of check valves, low speed jet, idle well jet, pump jet, and that all screw plug shoulders have not been damaged.

(4) If bottom of float bowl shows oxidation, indicating presence of water, remove all deposit with a wire brush and paint inside of bowl with a good grade of auto body lacquer.

48. CIRCUIT SERVICE METHOD.

a. The overhauling of carburetors by the Circuit Service Method is the fastest and simplest method. By grouping the parts and the installation of such parts in groups, it will usually be found that each group can be installed completely before proceeding to the next group. It may be necessary to divert from this system when installing one or two parts. It is suggested that the serviceman use a sectionalized pan or muffin tin to separate the groups of parts.

49. INSPECTION, REPAIR, AND ASSEMBLY OF FLOAT CIRCUIT PARTS.

a. Service Requirements. Service requirements of the float circuit do not differ greatly from those of any other. The bowl must be effectively sealed with a new gasket. The float must not be loaded, damaged or worn. The bowl vent must be clean and not restricted. The float level must be set to specifications.

b. Assembly. Group all parts controlling gasoline level, namely: float bowl cover, float and pin, needle and seat assembly, and bowl cover gasket. Install bowl cover gasket and needle seat in bowl cover. Install needle in seat, then install float and float pin.

c. Float Setting. The method of setting the floats in these carburetors differs slightly from those previously discussed. It is performed in the following manner:

(1) Hold bowl cover level in inverted position and view from

free end of float. Float should be centered and at right angles to the bowl cover.

(2) Lift up and swing narrow end of bowl cover gasket aside.

(3) Gage (⅜ in.) should just pass between machined surface of cover and free end of float, with gage held across cover at right angles to float. Adjustments must be made by bending the float lip only.

(4) When float is gaged, no pressure is applied to the float. At this time, only the weight of the float is pressing against the spring in the needle assembly. If bowl cover is not held absolutely level, the float pressure on the spring will vary and thus cause incorrect float setting.

50. INSPECTION, REPAIR, AND ASSEMBLY OF PUMP CIRCUIT PARTS.

a. Service Requirements. The plunger leather must be pliable and undamaged. Soak the plunger in gasoline for a short time if leather is hard. This pump circuit is called "wet pump" gasoline being on top of the plunger as well as under. The spring beneath the plunger in the pump cylinder should never be altered in any way. The check valves and the pump jet must be clean and undamaged, and each of these parts must effect a seal in the casting. A loose or poorly seated pump jet will permit fuel to be discharged through the vent hole in the outside of the main body casting. The pump travel must be set according to the instructions given in paragraph 53. Adjustment cannot be made until additional parts have been installed.

b. Assembly. Group all pump system parts, including pump jet and plug, intake and discharge checks, strainer, check valve passage plug, pump plunger and spring. Install pump jet and passage plug. Install discharge and intake check assemblies. Press strainer into place in strainer plug, then install as assembled. Install pump spring and plunger.

51. INSPECTION, REPAIR, AND ASSEMBLY OF LOW SPEED CIRCUIT PARTS.

a. Service Requirements. The flange gasket between the base of the main body, insulator, and the body flange assembly must effectively seal so that air will not leak into the idle passage, and thus dilute the mixture. The throttle bore must be free from all carbon deposit. When servicing these units, the low speed jet assembly must be removed before the idle well jet; likewise, when assembling, the idle well jet must be installed before the low speed jet.

b. Assembly. Group all low speed circuit parts, namely: throttle body, throttle shaft and valve, idle adjusting screw and spring, low

TYPE W-0 CARBURETOR, MODELS 450S AND 539S

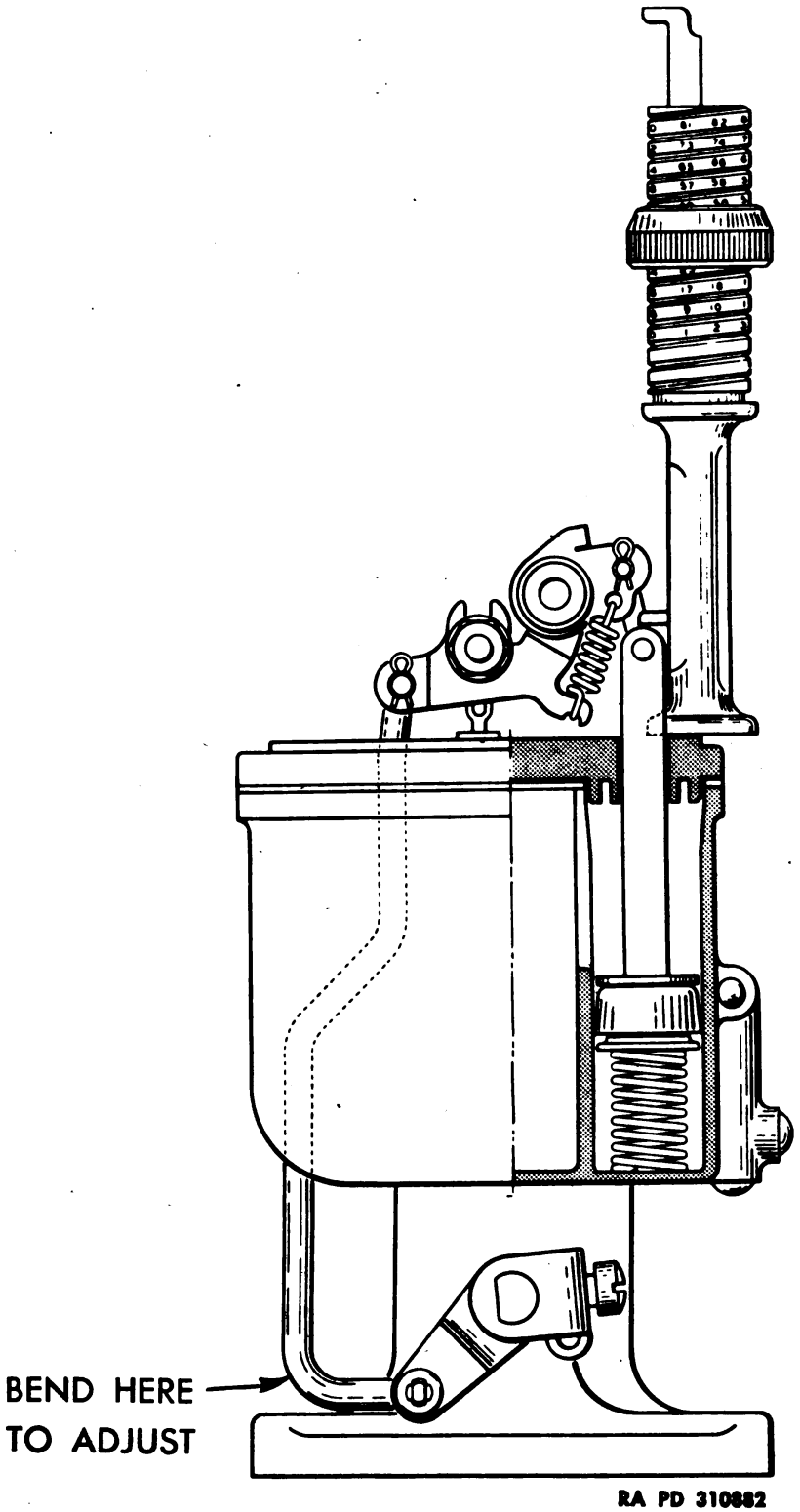

Figure 31 — Pump Travel Gaging with Gage 41-G-256

speed jet and passage plug, idle well jet and passage plug, insulator and gaskets. Install throttle shaft and valve and back out throttle lever set screw. Tap throttle valve lightly against bore to centralize it before tightening screws. Install idle adusting screw and spring. Assemble flange to body. Install idle well jet and plug. Install low speed jet and plug. (Idle well jet must be installed before low speed jet.) All parts in this group have now been installed.

52. INSPECTION, REPAIR, AND ASSEMBLY OF HIGH SPEED CIRCUIT PARTS.

a. Service Requirements. The nozzle and nozzle retainer plug must be clean, undamaged and properly installed. Only one gasket should be installed between the nozzle and its seat in the main body casting. The importance of one gasket at this point has been illustrated in figure 15. When the carburetor is overhauled, a new metering rod jet should be installed because visual inspection may not reveal the wear that has taken place. The metering rod spring must be hooked to the metering rod (through the hole in the rod on the 539S carburetor) to hold it in a steady position in the metering rod jet. The metering rod must be properly gaged or the delivery of fuel by the high speed circuit will be incorrect throughout its range. Procedure for gaging the metering rod is given in paragraph 53.

b. Assembly. Group all high speed circuit parts, namely: nozzle and gasket, retainer plug and nozzle passage plug, metering rod and jet, metering rod disk, throttle shaft lever and connector rod and retainers, pump arm and collar assembly and pump link. Install metering rod jet. Install bowl cover as assembled. Install pump arm and collar assembly on countershaft in bowl cover and then install pump connector link. Install throttle shaft arm and throttle connector rod. Install nozzle, one nozzle gasket, nozzle retainer plug, and nozzle passage plug.

53. PUMP ADJUSTMENT AND METERING ROD SETTING.

a. Pump Travel is the vertical distance the pump plunger travels from fully closed throttle to wide open throttle. Procedure for gaging is as follows:

(1) Back out throttle stop screw in throttle lever and hold throttle in fully closed position.

(2) Place base of gage (41-G-256) on raised portion of bowl cover with notch against plunger rod.

(3) Turn knurled nut on gage until projecting finger rests on top of plunger rod assembly (fig. 31).

(4) Remove gage and observe figure closest to index mark on beveled edge of knurled nut.

TYPE W-0 CARBURETOR, MODELS 450S AND 539S

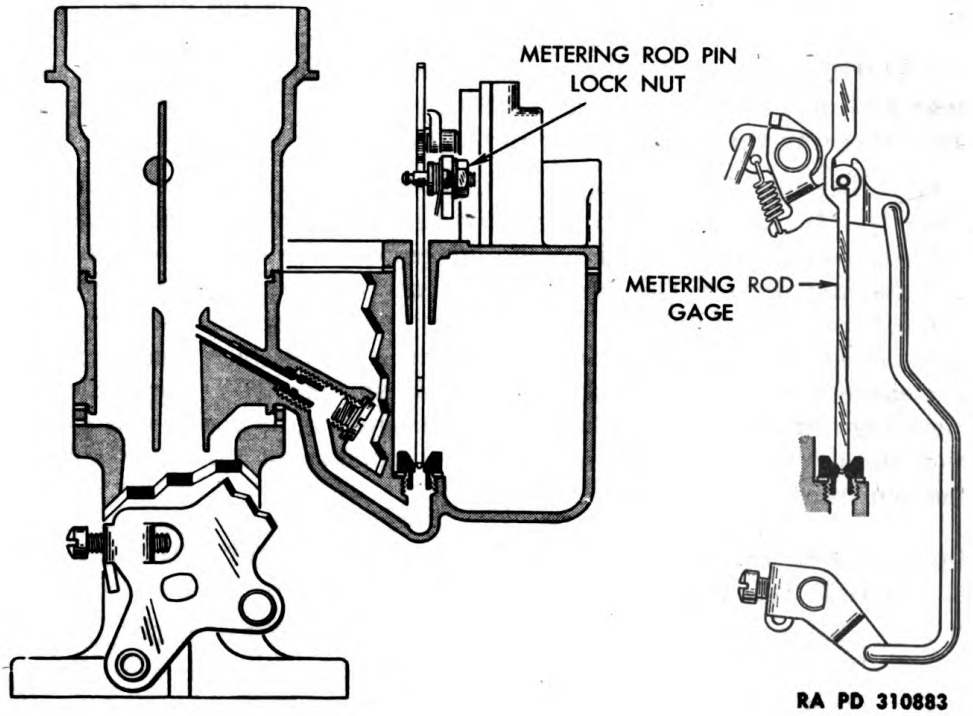

Figure 32 — Metering Rod Gaging with Gage 41-G-234-50

(5) Open throttle wide and again check height of plunger with gage.

(6) Observe closest figure indicated on gage as before.

(7) Subtract wide-open throttle reading from fully closed throttle reading, thus obtaining pump travel in 64ths of an inch.

NOTE: *Correct pump travel is $1\frac{7}{64}$ inch. A tolerance of $\frac{1}{64}$ inch either way is allowable. To change pump travel, bend throttle connector rod at lower angle next to throttle arm. To increase pump travel, bend throttle connector rod to raise starting position of plunger. To decrease pump travel, bend throttle connector rod to lower starting position of plunger.*

CAUTION: *Pump travel must be adjusted before metering rod gaging is performed.*

b. Metering Rod Gaging. Metering rod must be properly gaged or delivery of fuel by the high speed circuit will be incorrect throughout its entire range. The procedure is as follows:

(1) Insert metering rod gage (41-G-234-50) in place of metering rod, seating tapered end in metering rod jet (fig. 32). Hold throttle in fully closed position. (Throttle stop screw backed out away from stop.) Metering rod pin on arm should be free but there should be

less than 0.005-inch clearance between the metering rod pin and step of gage. Reset metering pin height, if necessary, by using wrench (41-W-910) to loosen or tighten metering rod pin lock nut. Remove gage and install metering rod and disk, making sure to install metering rod spring through the hole in the metering rod.

c. Alternate Method of Gaging Metering Rod Carburetor on Vehicle. If it is desired to gage metering rod while carburetor is on vehicle, and a tachometer is available, remove the sheet metal elbow and the top portion (air horn) of the carburetor. Start the engine and adjust for normal idle (600 rpm). At this speed the metering rod should be seated in the jet, the metering rod pin should show a clearance of less than $\frac{1}{64}$ inch below the top of the eye of the metering rod. At 900 revolutions per minute engine speed, this clearance should be zero, and at speeds above 1,000 revolutions per minute the pin must lift the rod.

54. INSPECTION, REPAIR, AND ASSEMBLY OF CHOKE CIRCUIT PARTS.

a. Service Requirements. The air horn must be clean and undamaged and the choker valve must not drag on inner wall of air horn. Choker pull back spring must not be damaged or difficult starting may result.

b. Assembly. Group all choke circuit parts, namely: air horn, choker shaft and valve and screws, choke tube bracket assembly and pull back spring, choker connector link, spring and retainer pin. Install air horn on body. Install choker shaft and valve. Seat valve in bore of carburetor before tightening screws. Install choker tube bracket and connect choker pull back spring. Install connector link and pin spring.

c. Fast Idle Adjustment. The choke and throttle levers are connected by the choker link. This link opens the throttle slightly during choking period. To adjust, hold throttle valve closed and move choke to closed position. Throttle should be pulled open between 0.080 inch and 0.090 inch from its seat (this is the distance between throttle valve and bore of carburetor side opposite idle port). Adjustment may be made by bending choker connector link at off-set portion to give proper throttle opening. Be sure the bending is done at the off-set and that the ends of the link are parallel, so that no binding occurs at either end.

CHAPTER 6

BALL AND BALL DOWNDRAFT CARBURETORS (WITHOUT GOVERNORS)

Section I

DESCRIPTION

55. SCOPE.

a. These BB carburetors, as they are known, are identical as to design, construction, and service requirements. However, the calibrations are varied to suit the needs of the different engines on which these units are used. This chapter includes carburetor models D6A2, D6B2, D6C2, D6G1, DTA2, DTB2, DTC1, ETP2, ETR1, ETT1 and EL1.

56. FLOAT CIRCUIT.

a. Function. Fuel is admitted through the needle seat into the fuel bowl in the main body, and as the fuel rises, the float closes the needle valve at the proper fuel level. This proper fuel level is controlled by the setting of the float. These BB carburetors all employ what is called a "balanced" or inside bowl vent, and is accomplished by means of a tube which projects into the carburetor air horn above the choke valve. This vent passage does not lead directly to the bowl but directly to the pump jet well, then to the bowl. The reason for this deviation will be discussed in the section covering the pump circuit

57. LOW SPEED CIRCUIT.

a. Function. Fuel from the carburetor bowl is pushed through the calibrated hole at the bottom of the low speed jet (in this carburetor it is usually called idle orifice tube) which extends into the high speed passage. This fuel then flows through the tube and through the cross passage in the carburetor body, where it is mixed with a small quantity of air which is admitted from the carburetor air horn. The fuel and air then pass down through a restriction in the passage called the "economizer" which not only accomplishes a more complete mixing of the fuel and air, but also limits the flow through the idle circuit. The mixture then passes down the remainder of the idle passage

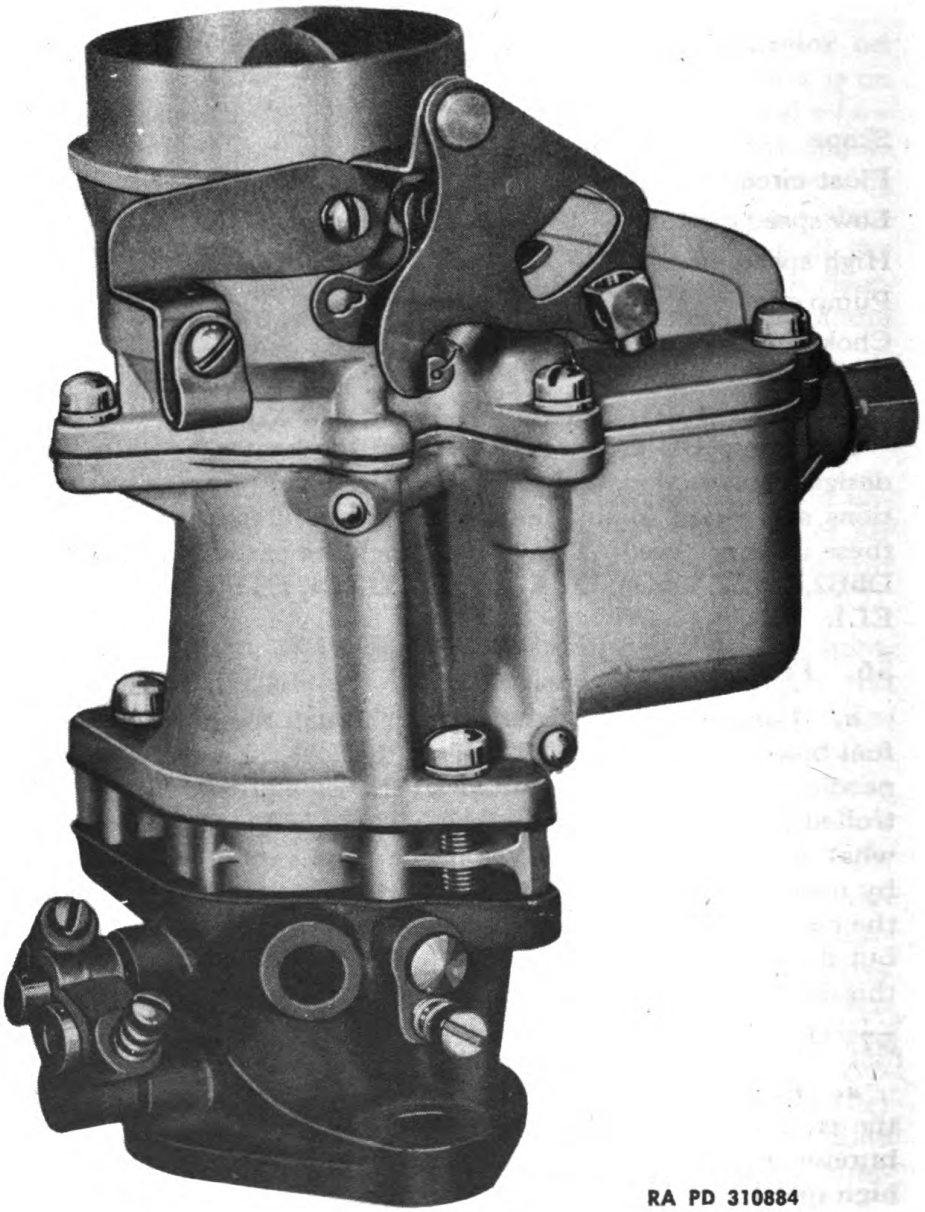

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Figure 33 — Typical Ball and Ball Downdraft Carburetor

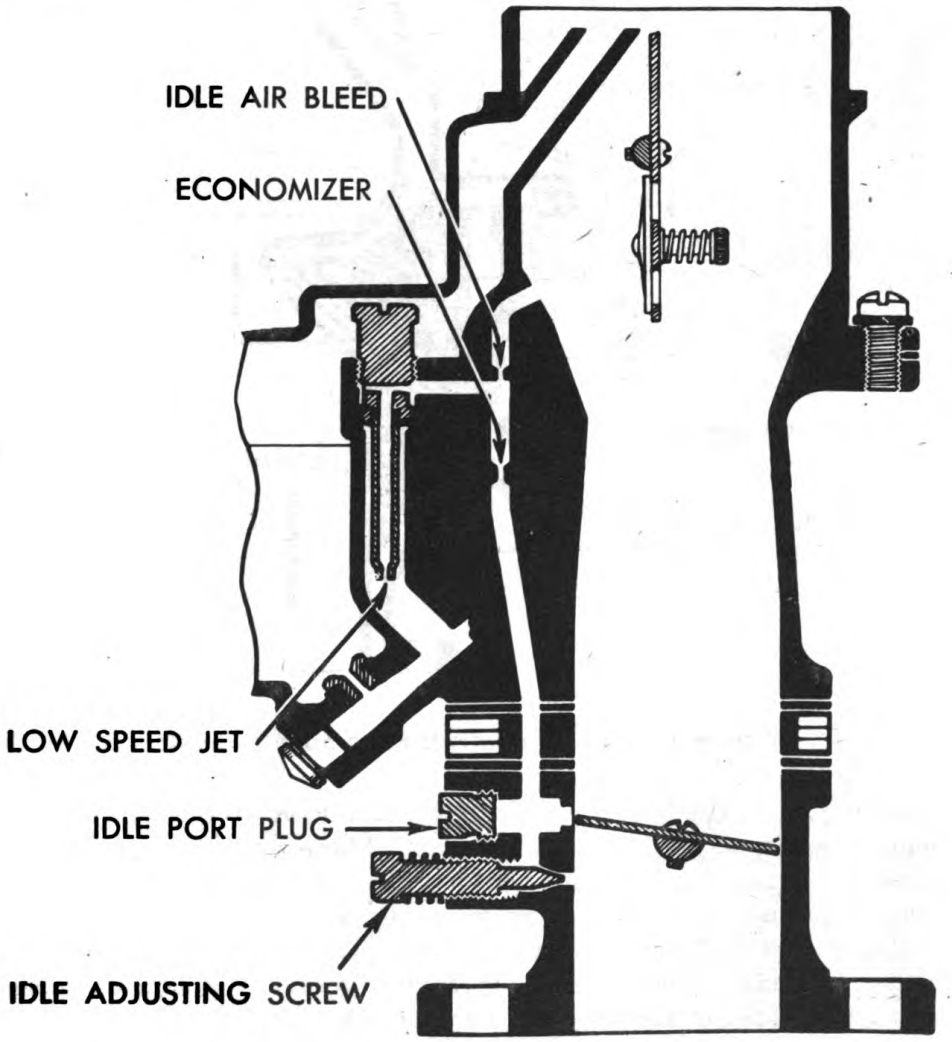

Figure 34 — BB Downdraft Low Speed Circuit

where it is discharged from the idle port and the idle adjustment screw hole into the low pressure air stream below the throttle valve. As on other types of Carter carburetors, a leaner mixture is obtained by turning the idle adjustment screw in, and conversely, backing out the idle adjustment screw will produce a richer idle mixture. This mixture, issuing from the idle port and the idle adjustment screw hole, is too rich to operate the engine, but when it is mixed with the air, which has come past the throttle valve, it forms a combustible mixture of the right proportion for idle and low speed operation.

58. HIGH SPEED CIRCUIT.

a. Function. Fuel for this circuit is pushed through the main

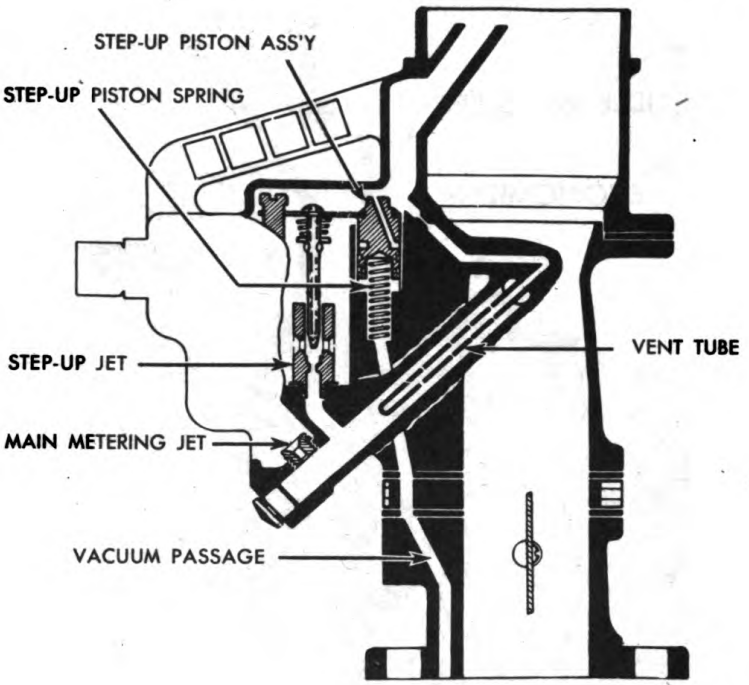

Figure 35 — BB Downdraft High Speed Circuit

metering jet in the bottom of the bowl, and flows up through the passage to be discharged into the air stream. These carburetors do not use a nozzle extending into the venturi, but use a diffuser bar, which extends across the center of the main venturi. The diffuser bar is in reality an air foil and the action of the air passing over it results in action and effect as though it too were a venturi. A hole is drilled through the foil (at the throat of the venturi), and is connected directly to the passage from the bowl. As shown in figure 35, the main vent tube is pressed into the upper end of this passage and is connected by a horizontal passage to the air in the bowl, which is admitted to this tube through a small hole adjacent to the idle tube in the carburetor bowl. In this way a small amount of air is allowed to premix with the fuel before it is discharged into the throat of the carburetor. There are a number of tiny calibrated holes in the vent tube through which the air is metered to mix with the fuel, before being discharged through the diffuser ports or "fish-eyes", as they are frequently called. Fuel which is metered through this part of the high speed circuit takes care of the light load demands of the engine throughout the part throttle range.

b. Vacuum Step-up Device. When the throttle is in wide open position, or when the load demand on the engine becomes excessive, it is necessary to provide an additional amount of fuel. This additional

BALL AND BALL DOWNDRAFT CARBURETORS (WITHOUT GOVERNORS)

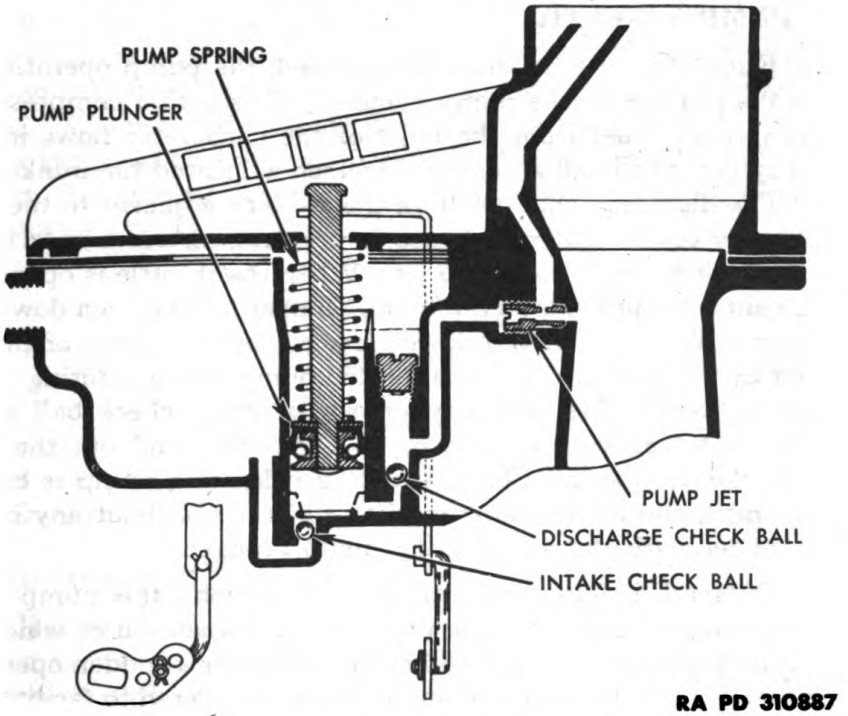

Figure 36 — BB Downdraft Pump Circuit

amount of fuel is controlled by the vacuum step-up device, and is metered through the step-up jet. This fuel then flows into the same passage as the fuel from the main metering jet and, hence, it too is discharged through the "fish-eyes". The flow of fuel through the jet is directly controlled by a pointed rod inserted in the jet and is called the step-up rod. This rod in turn is fastened to a vacuum piston operating in a cylinder adjacent to the step-up jet. Beneath the piston is the calibrated step-up spring which tends to lift the step-up piston plate and rod assembly and thus permit fuel to flow through the step-up jet. The step-up piston cylinder is connected by a passage through the main body, insulator and flange, to a point below the throttle valve. Thus the step-up piston is subjected to two opposing forces; first, the force of the step-up spring which tends to push it upward; and second, the differential pressure that exists between the pressure in the carburetor bowl and the pressure in the manifold (which tends to push it downward). When the load demand on the engine is light, manifold vacuum will be high and the difference between the manifold vacuum and the pressure in the bowl will cause the step-up piston to be held down against the tension of the spring, hence the step-up jet is closed. When the load demand is great, regardless of throttle opening, manifold vacuum will be low and the step-up spring will raise the step-up piston and rod, thereby permitting the additional fuel to enter the high speed circuit to take care of the load demand. (See fig. 35.)

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ORDNANCE MAINTENANCE — CARBURETORS (CARTER)

59. PUMP CIRCUIT.

a. Function. As the throttle is closed, the pump operating link raises the plunger in the pump cyinder. This action compresses the pump spring. Fuel from the bowl of the carburetor flows into the pump cylinder through a passage in which is located the intake check ball. The discharge check ball, in the passage adjacent to the pump cylinder, is on its seat and hence it prevents air from entering the pump circuit through the pump jet. When the throttle is opened, the pump connector link allows the pump plunger to be driven downward. The pump plunger is driven downward, not by the action of the linkage but by the pressure of the calibrated pump spring. During the discharge stroke, the fuel pressure forces the intake check ball to seat, the fuel is forced past the discharge check ball and out the pump jet into the air stream. This type of accelerating pump is called a "wet pump", and as the name implies, functions without any cushion of air underneath the accelerating pump plunger.

b. Delayed Action. For its "delayed action", this pump circuit depends entirely upon the pump spring, the expansion of which continues the discharge of fuel for a brief period after a sudden opening of the throttle. The top of the pump cylinder is tapered to facilitate the installation of the plunger.

c. Pump Relief. On circuits where the pump circuit is not allowed to bleed over at constant throttle, the method used to prevent this "pull-over" is called pump relief. An inspection of the balanced vent passage, previously described in the float circuit, will reveal that it not only provides a vent to the bowl, but it also vents the pump through a cross-drilling in the sides of the jet. Therefore, it is obvious that the low pressure effect at the end of the pump jet is destroyed by connecting it to the bowl vent. In this way, a balance is achieved between the pressure in the bowl and the pressure at the end of the pump jet. Under this condition, no fuel can be delivered from the pump circuit at constant throttle.

60. CHOKE CIRCUIT.

a. Function. When the choke is used, the mixture is enriched by cutting down the amount of air admitted through the carburetor. These carburetors use a choker valve with a semi-automatic feature, the choke being connected to the operating lever by a soft spring. The choker valve is also mounted off-center in air horn, the longer section on the lower side of the choker shaft, so that it will tend to open of its own accord. In choking position, the spring action mentioned allows the choke to "breathe" with the engine and to lessen the sensitivity of the choke control. Furthermore, a poppet valve is provided in the choker valve to allow inward relief and hence lessen the danger of over-choking when the engine starts to run.

b. Fast Idle. Some of these carburetors, the ones used on passenger cars, are equipped with a choker connector rod and throttle shaft dog. The rod acts as a link between the choker shaft lever and the dog. When choke is being used, throttle shaft dog is rotated on the cast iron boss beneath the throttle shaft, and lifts the throttle stop screw in the throttle lever assembly, thereby increasing the motor speed during the choking period.

Section II

DISASSEMBLY

61. DISASSEMBLY.

a. Remove and Disassemble Air Horn. If the carburetor being serviced uses a connector rod between the choke lever and throttle dog, remove throttle lever and disconnect connector rod. Then remove bowl cover, and gasket. Remove choker bracket assembly, choke valve, and slide out choker shaft with spring attached.

b. Remove and Disassemble Throttle Body. Remove pump connector link. Remove flange attaching screws, and separate throttle body from main body casting. Remove idle adjusting screw and spring, idle port plug and throttle lever. Then remove throttle valve screws and slide out shaft.

c. Disassemble Body Casting. Remove pump plunger assembly, float pin retainer, pin, and float. Remove needle seat assembly using socket or box socket wrench. Never use open end wrench or pliers when removing or installing needle seat. Remove pump jet and plug, low speed jet, step-up piston assembly, step-up jet and main metering jet. Remove discharge check ball and plug.

(1) MAIN VENT TUBE. Invert body casting and remove high speed passage rivet plug with rivet extractor (41-E-557). Insert threaded portion of remover (41-R-2384-25) and turn clockwise until shoulder of remover rides against casting. An additional turn will loosen main vent tube so that it can be lifted out of casting. See special instructions for installing new tube (par 66 d).

(2) REMOVAL OF INTAKE CHECK BALL. Insert pointed end of remover (41-R-2370-10) between retainer ring and wall of cylinder. Place finger over top of pump cylinder and twist tool so that point extends toward center of cylinder, then lift tool. Ring will not be loose in cylinder so ball and ring can be removed.

Section III

CLEANING, INSPECTION, REPAIR, AND ASSEMBLY

62. CLEANING AND INITIAL INSPECTION.

a. Body Casting. Soak the casting for a short time in dry-cleaning solvent, then blow out with compressed air. All passages must be clean. Note particularly that idle vent is clean and undamaged and that shoulders where jets seat have not been damaged. Be sure to remove old step-up piston gasket.

b. Throttle Body. The bore must be free from carbon deposit where the throttle valve seats. All carburetors are subject to this deposit after prolonged low speed operation. Wet or dry sandpaper aids greatly in removing it. Blow out passages with compressed air.

c. Air Horn. Soak in dry-cleaning solvent and blow out with compressed air. Check air horn for out-of-round and wear in choke shaft bearings. Check portion which extends over bowl for warpage.

d. Small Parts. Soak small parts in dry-cleaning solvent and dry with compressed air. Parts which are to be replaced, such as those listed below, need not be cleaned. When the carburetor is completely overhauled, the installation of a repair parts package is recommended and includes the following parts: needle and seat, float pin, pump plunger, check balls, pump link, low speed jet, main vent tube, step-up jet, main metering jet, step-up piston plate assembly, all necessary gaskets, screws, plugs, springs, and retainers.

63. CIRCUIT SERVICE METHOD.

a. The overhauling of carburetors by the Circuit Service Method is the fastest, simplest method. By grouping the parts and the installation of such parts in groups, it will usually be found that each group can be installed completely before proceeding to the next group. It is suggested that the servicemen use a sectionalized pan or muffin tin to separate each group of parts.

BALL AND BALL DOWNDRAFT CARBURETORS (WITHOUT GOVERNORS)

64. INSPECTION, REPAIR, AND ASSEMBLY OF LOW SPEED CIRCUIT PARTS.

a. Service Requirements. The service requirements of this low speed circuit do not differ greatly from those of any other. The head of the low speed jet must seat tightly in the casting so that the only fuel which passes is metered through the calibrated orifice at the lower end of the tube. If it is not installed securely, fuel will leak past the seat, resulting in an idle mixture that cannot be properly controlled. The idle vent and economizer must be clean and the original size unaltered by improper methods of cleaning. The body gasket between the main body, the insulator, and the body flange assembly, must form an effective seal, so that air will not enter the idle passage at this point and alter the mixture. The throttle shaft and throttle valve must be undamaged, free from wear and properly installed. All passages must be clean.

b. Assembly. Group all parts controlling the low speed circuit, namely: throttle shaft and screws, idle port plug, idle adjusting screw and spring, flange insulator and gaskets, low speed jet, and throttle lever. Install throttle shaft and throttle valve. Small "c" in circle (©) should be toward the idle port and facing the manifold (down). Center valve by tapping lightly and hold in place before tightening screws. (Always use new screws.) Install throttle lever. Install idle port rivet plug, then install idle adjusting screw and spring. Install insulator and gaskets. Be sure holes in casting, insulator, and gaskets line up properly. Install body casting and securely tighten screw. Install low speed jet but do not tighten it (the low speed jet acts as a guide for the step-up piston plate and must be removed when installing plate assembly).

65. INSPECTION, REPAIR, AND ASSEMBLY OF PUMP CIRCUIT PARTS.

a. Service Requirements. The pump plunger leather must be soft and pliable and the spring under the leather must be clean and undamaged. Pump jet must be clean and undamaged and must be seated securely in the casting. To avoid leakage the large rivet plug, installed in back of the pump jet, should be replaced with a new one each time it is removed. The check balls must be clean and free of gum. The smaller of the two check balls is the intake check in the bottom of the pump cylinder. The larger of the two check balls is the discharge check and is located in the passage adjacent to the pump cylinder. Do not mix. The pump linkage must be free from wear at the end of the pump operating link.

b. Assembly. Group all pump circuit parts, including pump plunger, spring, link, and operating link, intake check ball and retainer, discharge check ball and plug, pump jet and plug.

Install pump jet and pump jet rivet plug. Install pump discharge check ball and plug. (The discharge ball is the larger.) Install intake check ball and retainer. Use bender (H1-B-533) to insert retainer. Install pump plunger, spring, and pump operating link. Install pump connector link in center hole of throttle shaft lever.

c. **Pump Adjustment.** Pump travel must be set according to specifications. On all these models, the pump operating link should be installed in the center hole when measuring the travel of the plunger with universal pump stroke gage (41-G-256). NOTE: *Pump travel is the vertical distance the plunger travels from fully closed throttle to wide open throttle. Consult specification sheet as to correct pump travel for exact carburetor being overhauled.* Adjustment of the pump travel is as follows:

(1) Place extractor (41-E-557) on top of body next to pump cylinder, flat side down, and as close to plunger rod as possible. This will now serve as a pedestal for the gage 41-G-256.

(2) Back out throttle stop screw in throttle lever and hold throttle in fully closed position.

(3) Stand gage vertically on pedestal formed by extractor tool, and turn knurled nut on gage until projecting finger rests on top of plunger rod, not on connector link.

(4) Remove gage and observe figure closest to index mark on beveled edge of knurled nut.

(5) Open throttle wide and push plunger to bottom of cylinder.

(6) Using gage, as before, measure height of plunger (at top of plunger rod).

(7) Observe closest figure indicated on gage.

(8) Subtract wide open throttle reading from fully closed throttle reading. The answer is the distance pump plunger has traveled in 64ths of an inch.

(9) To increase pump travel, hold throttle closed and raise plunger and rod assembly by bending flat portion of connector link, using slotted end of tool T109-41. To decrease pump travel, bend connector link (as above) to lower plunger and rod assembly. Regage.

66. INSPECTION, REPAIR, AND ASSEMBLY OF HIGH SPEED CIRCUIT PARTS.

a. **Service Requirements.** All parts must be clean and not worn or damaged. All passages must be clean. Particular attention must be paid to the step-up spring which must be undamaged and the exact one specified. Step-up rod must not show wear at the seat end and the step-up jet must be the exact one specified. The small hole in the bowl adjacent to the idle jet (this is the hole which measures

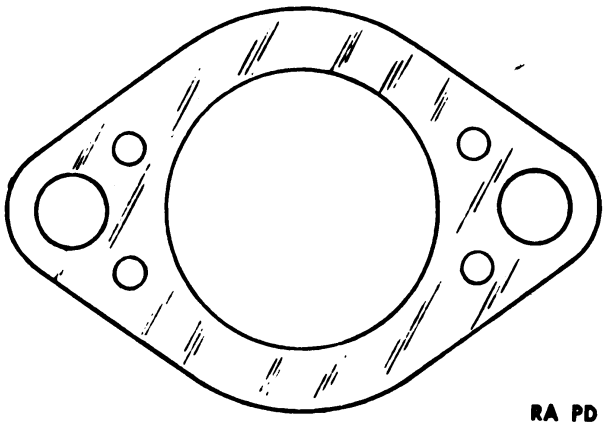

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Figure 37 — BM Carburetor to Governor Gasket

the air entering the main vent tube) must not be damaged by improper cleaning or sizing. Because the main vent tube is forced into the casting, it cannot be successfully used a second time. The passage plug at the lower end of the high speed passage must also be renewed to insure a gasoline-tight seal. The main metering jet is taper reamed and must never be cleaned with wire or probed with any instrument. Such practice would ream a portion of the taper or at least scratch the surface of the taper which would materially affect the flow of the jet. There must be only one gasket in the step-up piston cylinder beneath the step-up piston. After installation, press down on piston until it is seated in bottom of cylinder. There should be a slight clearance between step-up piston plate and the head of the step-up piston rod. This clearance indicates that step-up pin is seating in jet.

b. Carburetor Flange Gasket. Although the carburetor flange gasket is not essentially a part of the high speed circuit, the improper selection of a gasket materially affects the operation of the circuit. Figure 35 shows the vacuum passage leading from the step-up piston cylinder in the face of the carburetor flange. If the carburetor is used in conjunction with a speed governor, the gasket shown in figure 37 should be used between the carburetor and governor. If no governor is used, gasket shown in figure 38 must be used between carburetor and manifold in order to insure the connection of the vacuum step-up passage to the intake manifold. This gasket should also be used between the governor and the manifold for the same reason.

c. Assembly. Group all parts controlling the high speed circuit, namely: main vent tube and plug, main metering jet, step-up jet, step-up spring, and step-up piston, and plate assembly. Install main metering jet and step-up jet. Install one step-up gasket in bottom of step-up cylinder. Install step-up piston spring, then step-up piston,

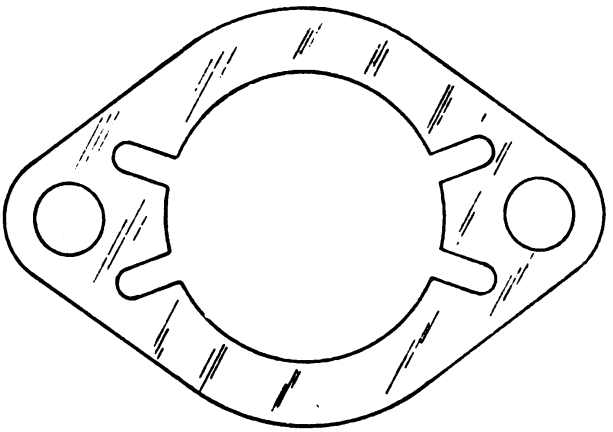

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Figure 38 — BM Mainfold Gasket

and plate assembly. Install main metering jet and step-up jet. Install one step-up gasket in bottom of step-up cylinder. Install step-up piston spring, then step-up piston and plate assembly. It is necessary to remove low speed jet assembly when installing step-up piston plate assembly, as end of plate uses head of low speed jet as a guide. Be sure to securely tighten low speed jet. Press step-up piston with finger as described in subparagraph a to be sure step-up is seating in jet.

(1) INSTALLATION OF VENT TUBE. Insert new main vent tube in hollow handle of remover (41-R-2384-25) (open end of tube extending from handle). Insert as assembled into high speed passage and tap projecting end of tool with hammer until solid sound indicates vent tube is securely seated in casting. Then install new rivet plug.

67. INSPECTION, REPAIR, AND ASSEMBLY OF FLOAT CIRCUIT PARTS.

a. Service Requirements. The bowl must be effectively sealed with a new gasket since it is imperative that air enter the bowl only through the calibrated bowl vent. The float must not be loaded, damaged, or worn. The needle valve and seat must be clean and not worn. The float level must be set to specifications.

b. Assembly. Group all parts controlling gasoline level, namely: needle and seat assembly, float and pin, and pin retainer. Install needle and seat assembly using socket or box socket wrench. Install float, and pin and pin retainer. Set float to specifications (fig. 39).

68. INSPECTION, REPAIR, AND ASSEMBLY OF CHOKE CIRCUIT PARTS.

a. Service Requirements. The air horn must be clean and un-

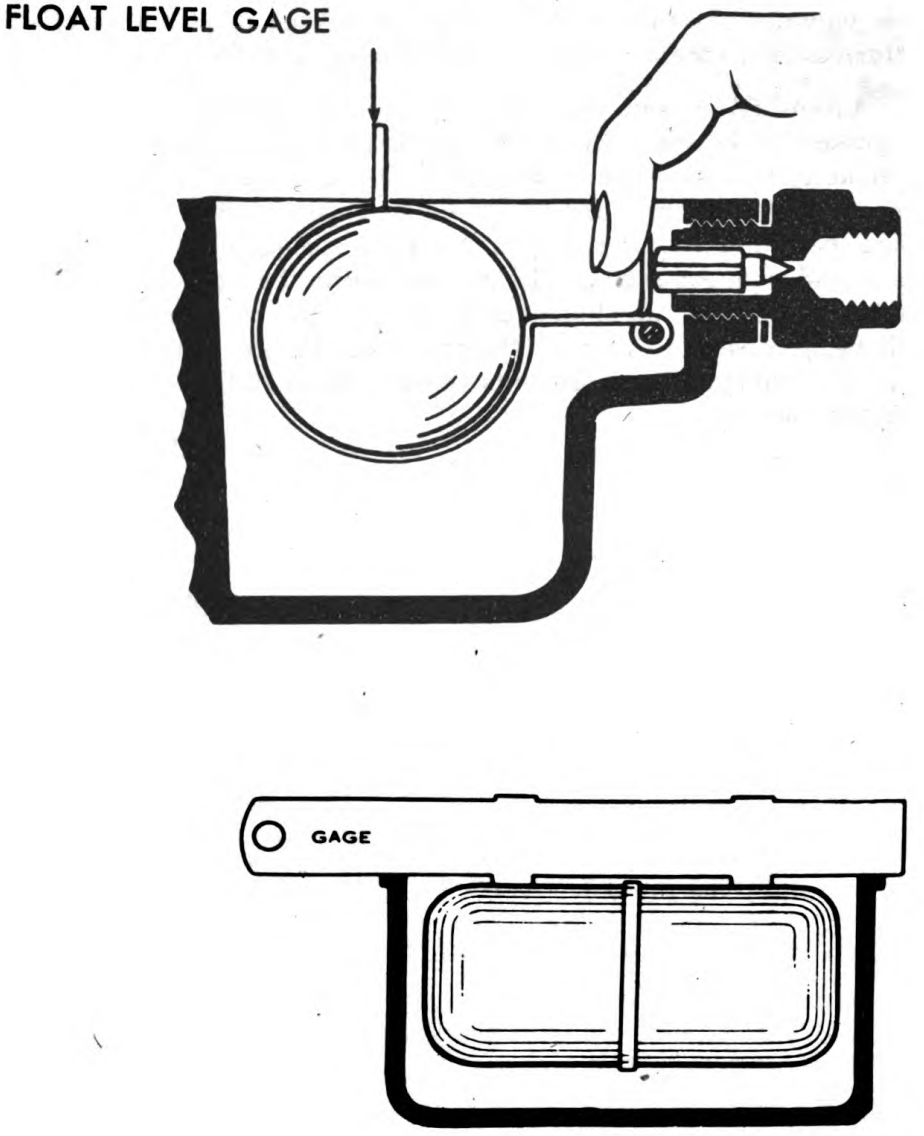

Figure 39 — Float Level Setting with Gage 41-G-187

damaged and the choker valve must not drag on the inner wall of the air horn. In the case of carburetors equipped with the throttle shaft dog and choker connector rod, care must be exercised to install the throttle shaft dog with the flat side toward the body flange assembly, and to attach the choker connector rod with the shorter section of the rod toward the air horn. If these precautions are not observed, the throttle shaft dog will fall off the boss of the flange; the choker connector rod, when installed upside down, will bind against the fitting in the vacuum spark port and will not allow the

choker valve to close completely. Choker linkage must not be oiled as abrasives will adhere to the oiled portion and greatly increase wear.

b. Assembly. Group all choke circuit parts, namely: air horn and bowl gasket, choke shaft, valve and spring, choke tube bracket assembly, choke connector rod and throttle shaft dog. Install air horn and gasket on body casting. Install choke shaft and valve. Seat valve in bore before tightening screws. Install spring and choke tube bracket and connect spring. If the carburetor being overhauled is the type which uses the choke connector rod and throttle shaft dog, it will be necessary to remove throttle lever before installing these parts. The throttle lever prevents the dog from sliding off the boss of throttle casting.

CHAPTER 7

BALL AND BALL UPDRAFT CARBURETORS, MODELS 447S, 489S, 517S, 6C2, 6D1, 6E1, 6F1, 6G1, 6J1, 6K1, BB1A

Section I

DESCRIPTION

69. SCOPE.

a. All ball and ball updraft carburetors are identical in design, construction and service requirements; however, the calibrations are varied to suit the needs of the different engines on which these units are used.

70. FLOAT CIRCUIT.

a. Function. Fuel is admitted through the needle seat to the fuel bowl in the main body. A suitable float is provided and, as the fuel rises, the float closes the needle valve at the proper fuel level. This proper fuel level is controlled by the setting of the float.

b. Bowl Vent. Some of these carburetors use an outside bowl vent, atmosphere entering the bowl through a hole in the bowl cover, while other units are "balanced" (use an inside bowl vent). The inside venting of the bowl is accomplished by a tube which projects into the air horn beyond the choker valve. This tube is connected to an annular passage between the upper body and the venturi. A drilled hole connects this passage to the top of the bowl. This annular space is sealed from the throat of the carburetor by means of two gaskets located on the venturi. A leak at this point or the elimination of one or both gaskets will upset the balanced feature of the carburetor.

71. LOW SPEED CIRCUIT.

a. Function. A sketch of the idle circuit is given in figure 42. Fuel from the carburetor bowl passes through the discharge ball cage assembly into the passage leading to the main metering jet. It then passes through the jet into the high speed passage and through the lower part of the nozzle to the well around the nozzle. From this point

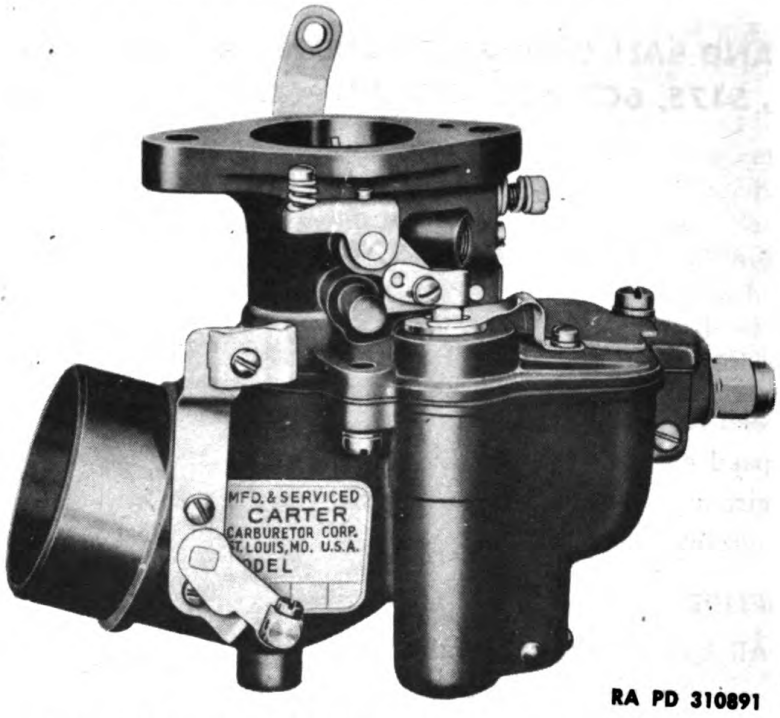

Figure 40 — Typical Ball and Ball Updraft Carburetor

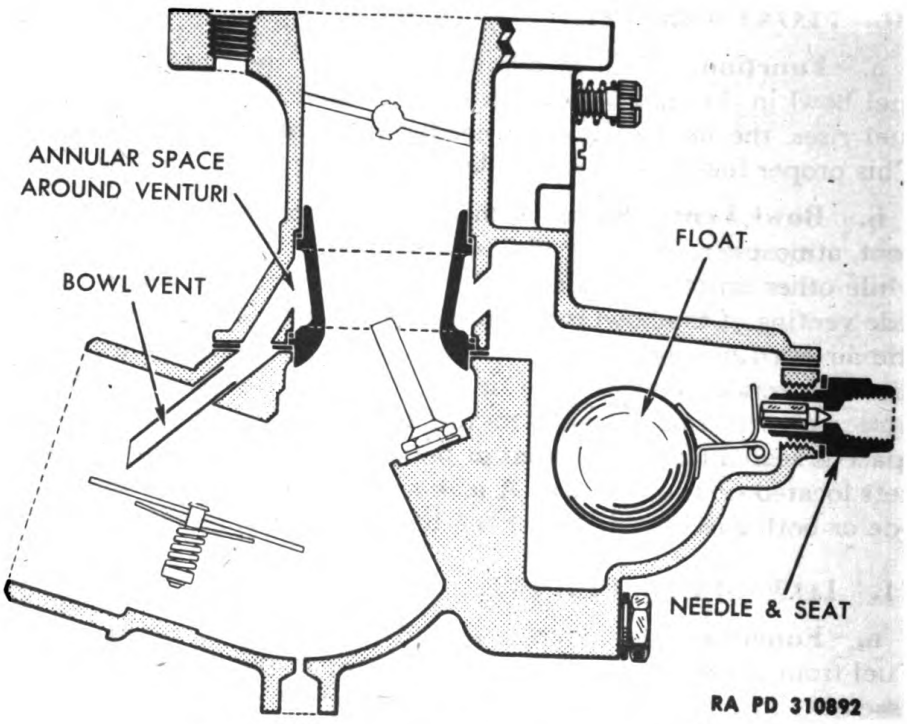

Figure 41 — BB Updraft Float Circuit

BALL AND BALL UPDRAFT CARBURETORS, MODELS 447S, 489S, 517S, 6C2, 6D1, 6E1, 6F1, 6G1, 6J1, 6K1, BB1A

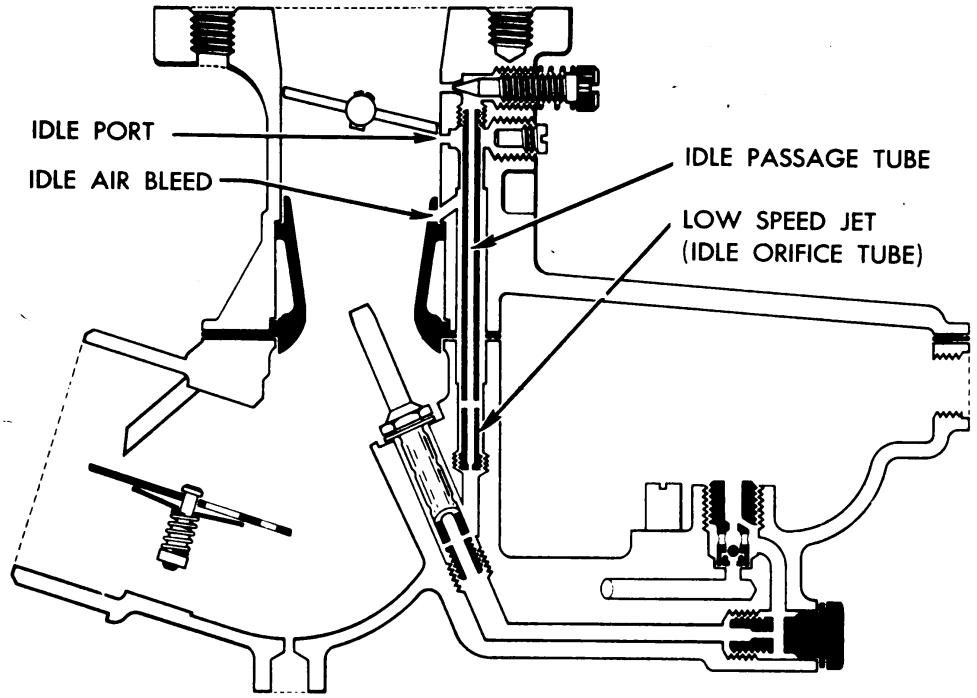

Figure 42 — BB Updraft Low Speed Circuit RA PD 310893

it is pushed through the calibrated hole in the low speed jet up into the idle passage, where it mixes with air which is admitted to the passage from the carburetor throat through the idle air bleed hole. This mixture is pushed up through the long idle passage tube to the idle adjustment screwhole, where it is discharged into the air stream. When the throttle is opened sufficiently to uncover the idle port (beneath the idle adjustment screw hole), the mixture of fuel and air is pushed up the outside of the idle passage tube to the idle port, where it is discharged into the air stream. When the idle port comes into operation, the level of gasoline in the idle passage rises to the idle air bleed hole. This lessens the output from the idle adjusting screw hole as at this time only liquid gasoline is carried up the inside of the idle passage tube. Like other types of Carter carburetors, a leaner mixture is obtained by turning the idle adjusting screw in, and, conversely, a richer mixture is obtained by backing out the idle adjusting screw.

72. HIGH SPEED CIRCUIT.

a. Function.

(1) Fuel for this circuit reaches the main metering jet through the pump valve cage assembly. Under all conditions except acceleration, the ball in the discharge valve cage is on its lower seat and the

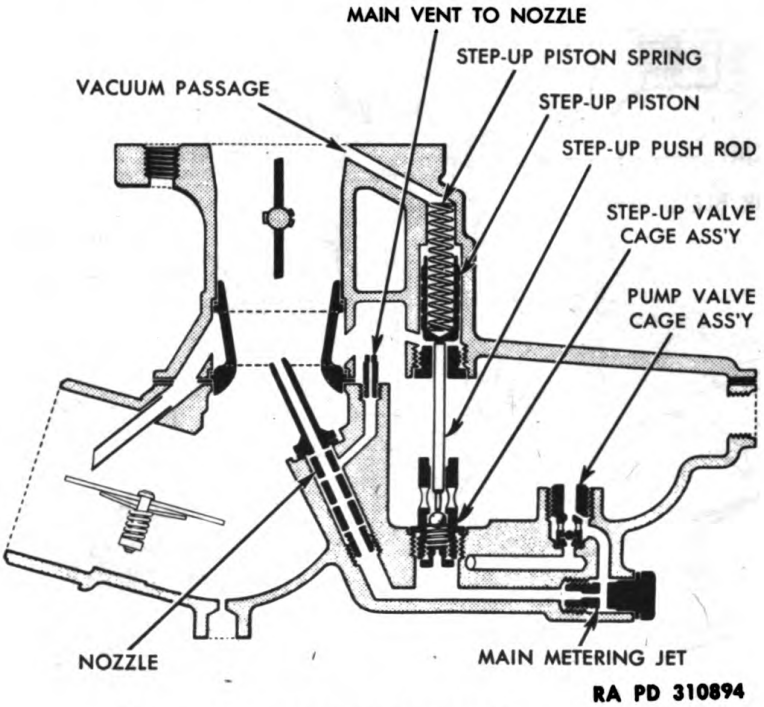

Figure 43 — BB Updraft High Speed Circuit

fuel must flow through the side drilling in the valve cage to reach the main metering jet. Here the fuel is metered through the main metering jet and pushed to the nozzle which is fitted with a series of small vent holes below the level of the fuel in the bowl. Air is introduced to these holes through a small upright vent tube in the bowl and in this way, air is premixed with the fuel before it is discharged from the nozzle. The high speed circuit as thus far described takes care of the light load demands of the engine throughout the part throttle range.

(2) When the throttle is in wide open position, or when the load demands on the engine become excessive, it is necessary to provide an additional amount of fuel. This additional amount of fuel is measured by the vacuum step-up device. It is metered through the step-up valve cage assembly and flows into the same passage as the fuel from the main metering jet, and, it too, is discharged through the nozzle. The flow of fuel through the step-up valve is directly controlled by a rod inserted in the valve. One end of this rod is of a smaller diameter and serves to open the valve by holding a small spring-loaded ball off its seat, which allows fuel to be pushed through the power orifice in the base of the valve. The step-up push rod is actuated by a spring-loaded vacuum piston in the upper body. The step-up piston is held in the upper body by a retainer plug. The top

BALL AND BALL UPDRAFT CARBURETORS, MODELS 447S, 489S, 517S, 6C2, 6D1, 6E1, 6F1, 6G1, 6J1, 6K1, BB1A

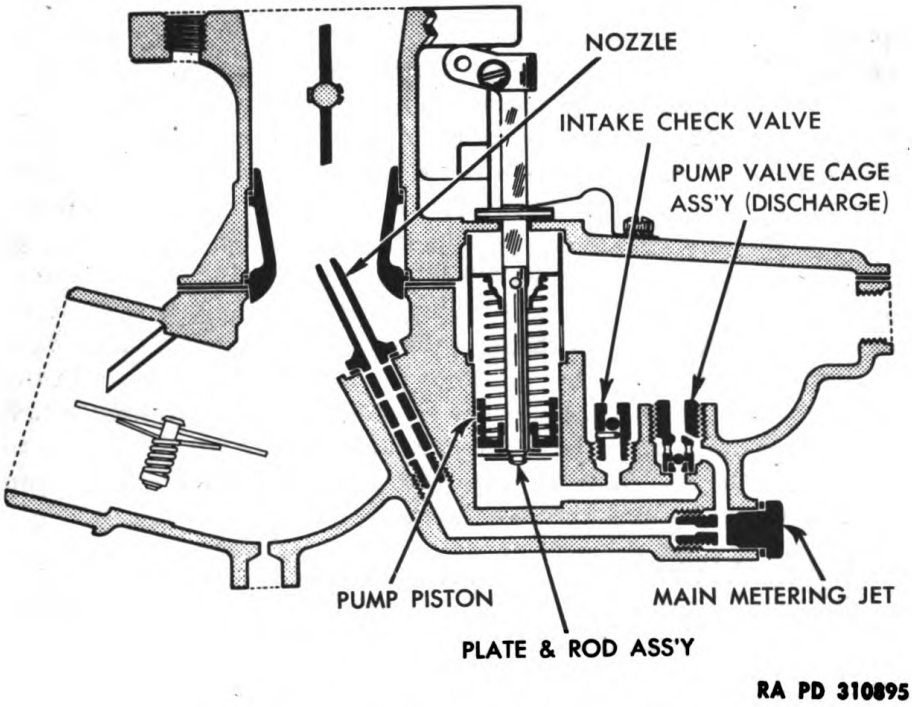

Figure 44 — BB Updraft Pump Circuit

of the step-up rod protrudes through a hole in this retainer and contacts the bottom of the step-up piston. The step-up piston cylinder is connected by a passage to a point above the throttle valve, thus the step-up piston is subjected to two opposing forces; the force of the step-up spring which tends to push it downward, and the differential pressure that exists between the pressure in the carburetor bowl and the pressure in the manifold. When the load demand on the engine is light, manifold vacuum will be high and the difference between the manifold vacuum and the pressure in the bowl will cause the step-up piston to be held up against the tension of the step-up spring. In this way the step-up valve is closed by the spring loaded step-up ball. Conversely, when the load demand is great, regardless of throttle opening, manifold vacuum will be low and the step-up spring and piston will push the rod down and open the valve. This permits the additional fuel to enter the high speed circuit to take care of the load demand.

73. PUMP CIRCUIT (fig. 44).

a. Function. When the throttle is closed, the pump link lifts the pump rod and plate assembly to the upper position in the pump cylinder compressing the pump spring. Fuel from the bowl of the carbu-

retor flows into the pump cylinder, entering through the intake check valve cage. On this stroke of the pump, the ball in the discharge pump valve cage assembly is on its lower seat and hence prevents the entry of fuel from the high speed circuit. When the throttle is opened, the pump link drives the pump rod and plate assembly downward, thus providing the initial push for the pump discharge. The pump piston, working on the pump rod and plate assembly, then follows under the pressure of the pump spring, providing the "delayed action" necessary to every accelerating pump. Under the pressure of the gasoline in the pump cylinder the intake check valve cage is closed, and the ball in the discharge pump valve cage assembly is held on its upper seat. Fuel then flows through the base of the pump valve cage and is discharged through the nozzle of the high speed circuit. In the pump valve cage assembly, there is a small diagonal bleed hole which allows surplus fuel from the pump circuit (during acceleration) to bleed back to the fuel bowl. These carburetors do not use a pump jet but discharge gasoline through the high speed nozzle.

74. CHOKE CIRCUIT.

a. Function. When the choke is used, the mixture is enriched by cutting down the amount of air admitted through the carburetor. A poppet valve is provided in the choker valve to allow inward relief and thus lessen the danger of over-choking the engine. The operation is essentially the same as the choke circuit of other Carter carburetors. However, there is no choker spring to provide breathing action.

Section II

DISASSEMBLY

75. DISASSEMBLY.

a. Remove and Disassemble Bowl Cover. If the carburetor being serviced uses a throttle connector rod between choker lever and throttle, disconnect rod from choker lever pin. Then remove bowl cover. Remove venturi and gaskets. Remove pump plunger assembly and connector link. Remove idle adjusting screw and spring, and idle port plug. Remove idle passage tube. Remove step-up piston plug, piston and spring. Remove throttle valve and shaft.

b. Disassemble Body Casting. Remove float pin and float. Remove step-up valve and both pump valve cages. Remove needle seat. Remove main metering jet. Remove nozzle, main vent to nozzle, and low speed jet. Remove choker valve, shaft and stub, and choke tube bracket.

BALL AND BALL UPDRAFT CARBURETORS, MODELS 447S, 489S, 517S, 6C2, 6D1, 6E1, 6F1, 6G1, 6J1, 6K1, BB1A

Section III

CLEANING, INSPECTION, REPAIR, AND ASSEMBLY

76. CLEANING AND INITIAL INSPECTION.

a. Lower Casting. Soak casting for a short time in dry-cleaning solvent, then blow out with compressed air. All passages must be clean. Be sure that none of the shoulders where jets seat have been damaged.

b. Upper Casting. The throat must be free from carbon deposit where the throttle valve seats. All carburetors are subject to this deposit after prolonged low speed operation. Wet or dry sand paper aids greatly in removing this deposit. Blow out passage with compressed air. After prolonged low speed operation, there is a tendency toward an excessive carbon deposit in the low speed passage. This deposit usually surrounds the idle air bleed, which is the passage leading from the bore of the carburetor to the low speed passage (through hole in the venturi).

c. Small Parts. Soak small parts in dry-cleaning solvent and dry with compressed air. Parts which are to be replaced such as those listed below, need not be cleaned. When the carburetor is completely overhauled, the installation of a repair parts package is recommended and includes the following parts: needle and seat, float pin, step-up push rod, low speed jet, vent tube, both pump check assemblies, step-up valve assembly, main metering screw, step-up piston and all necessary gaskets, plugs, springs, screws and felt packing.

77. CIRCUIT SERVICE METHOD.

a. The overhauling of carburetors by the Circuit Service Method is the fastest and simplest method. By grouping the parts and the installation of such parts in groups, it will be found that each group can be installed completely before proceeding to the next group. It is suggested that the serviceman use a sectionalized pan or muffin tin to separate each group of parts.

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ORDNANCE MAINTENANCE – CARBURETORS (CARTER)

78. INSPECTION, REPAIR, AND ASSEMBLY OF LOW SPEED CIRCUIT PARTS.

a. Service Requirements. The throttle bore, idle adjusting screw hole, and the idle port must be absolutely free from all carbon deposit. The idle air bleed hole must be clean and unrestricted. **NOTE:** *It is possible to block this hole by installing the die cast venturi with the matching hole in the side opposite the air bleed.* Care must be exercised to use the correct screwdriver in removal and installation of the low speed jet and idle passage tube. Both the idle port plug and the idle adjustment screw are the same diameter and thread. When the idle passage tube is installed in the upper body, it is impossible to interchange the idle port plug and the idle adjusting screw. Therefore, the idle passage tube should be installed before installation of idle port plug or adjustment screw, so that it will be impossible to interchange these parts. The throttle shaft and throttle valve must be undamaged, free from wear, and properly installed.

b. Assembly. Group all parts controlling the low speed circuit, namely: throttle shaft and valve, idle adjusting screw, spring, and idle port plug, low speed jet tube, and idle passage tube. Install throttle shaft and valve. Small "c" in circle must be toward the idle port and facing the manifold. Center valve by tapping lightly and hold in place when tightening screws. Always use new screws. Install idle passage tube. Install idle adjusting screw and spring, then install idle port plug. Install low speed jet but do not install too tightly as an excessive amount of pressure tends to spread the slotted portion of tube. All parts of the low speed circuit have now been installed.

79. INSPECTION, REPAIR, AND ASSEMBLY OF PUMP CIRCUIT PARTS.

a. Service Requirements. There must be no back-lash at the pump link screw as a result of wear. The pump sleeve must be installed over the pump cylinder in the main body with the two holes down. This will allow fuel, that bypasses the pump piston, to return to the bowl. Both check assemblies must be clean, unworn and free from gum which would impair the free operation of these parts. It is essential that the felt packing, the pump link cover plate washers and the packing retainer be properly installed to prevent an air leak to the bowl. A leak at this point would destroy the "balanced" feature by allowing atmosphere to the bowl.

b. Assembly. Group all parts controlling the pump circuit, namely: pump plate and rod assembly, piston, spring and retainer, pump operating link, felt packing and pump link cover plate washers and retainer, pin, upper pump cylinder, both pump check assemblies, and pump arm. Install pump arm on throttle shaft. Install pump operating link felt packing, washers and retainer. Install complete

pump assembly. Install pump sleeve with holes toward bottom. Install both check valve assemblies. All parts of this group have now been installed.

80. INSPECTION, REPAIR, AND ASSEMBLY OF HIGH SPEED CIRCUIT PARTS.

a. Service Requirements. All the parts must be clean, and not damaged. The step-up piston and push rod must not be worn. If the piston is worn, the step-up device will operate sooner than required. Furthermore, a worn step-up piston will cause a rich idle mixture because fuel on the surface of the push-rod will be pushed past the worn step-up piston and into the manifold. If the step-up push rod is installed upside down (large end down), free flow of fuel through the cross holes in the step-up valve will be prevented, consequently a lean condition will prevail under power or higher speeds.

b. Assembly. Group all parts controlling the high speed circuit, namely: nozzle, air bleed to nozzle, step-up jet and push rod, main metering jet, step-up piston, spring, and retainer plug. Install nozzle and air bleed to nozzle. Install step-up valve cage and main metering jet and push rod in step-up jet with small end down. Install step-up piston spring, piston and retainer plug. There is no gasket used above step-up piston. All high speed circuit parts have now been installed.

81. INSPECTION, REPAIR, AND ASSEMBLY OF FLOAT CIRCUIT PARTS.

a. Service Requirements. The bowl and the bowl vent passage around the venturi must be effectively sealed with new gaskets since it is imperative that air enter the bowl only through the calibrated vent. The float must not be loaded, damaged or worn. The float level must be set to specifications, the correct procedure is shown in figure 39.

b. Assembly. Group all parts controlling gasoline level, namely: float, pin and needle, and seat assembly. Install needle and seat assembly. Use socket or box socket wrench, do not use open end wrench or pliers. Install float and float pin. Set float level to specifications by bending lip, not float. Then install upper casting as assembled. Use new body gasket.

82. INSPECTION, REPAIR, AND ASSEMBLY OF CHOKE CIRCUIT PARTS.

a. Service Requirements. These carburetors use a two piece choke shaft; to one end is attached the choker operating lever, the other end is merely a stub shaft. Be sure to install choker valve with

air bleed hole to the bottom and poppet valve away from the incoming air.

b. Assembly. Group all parts for the choke circuit, namely: choker valve, both shafts, screws, and choker tube bracket assembly. Install choker tube bracket and carburetor identification tag. Install choker shaft and choker valve assembly (bleed hole down). If the carburetor being serviced uses a choker link, install link on pin of choker lever. Upper end of link rides on throttle shaft under pump arm. Valve must operate freely.

CHAPTER 8

TYPE WCD CARBURETORS, MODELS 553S, 564S, AND 566S

Section I

DESCRIPTION

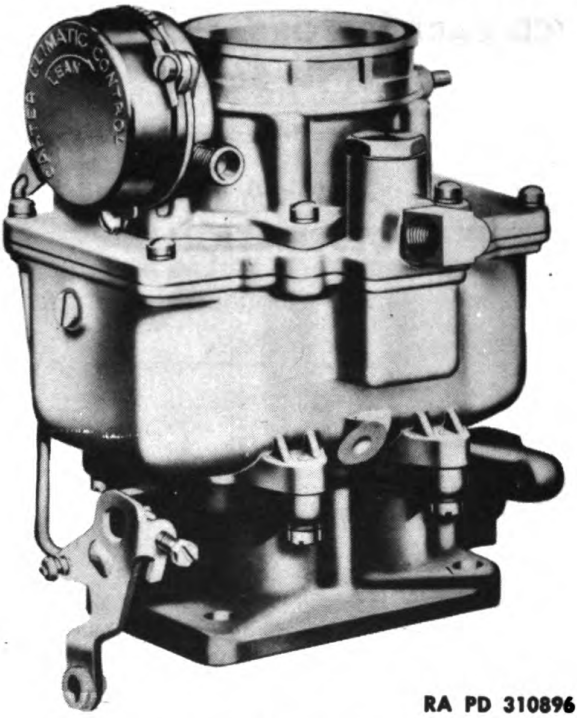
83. SCOPE.

a. The WCD carburetors are dual or double throat units used on M5 series light tanks and related motor carriages. They use an automotive device for choking, known as the "climatic control". Five circuits are employed in these carburetors. One float bowl is used to supply both throats with fuel. Two idle circuits are used, one for each throat; likewise two high speed circuits. The pump circuit consists of but one pump plunger and set of valves, and discharges fuel to both throats as the throttle is opened. The choke circuit uses a single choker valve, which is operated by the climatic control.

84. FLOAT CIRCUIT.

a. Function. Fuel enters the bowl through the needle seat. As the fuel rises in the bowl, the float closes the needle valve at the proper fuel level, which is controlled by the setting of the floats. In these carburetors there are two separate floats, each connected to a single lever which actuates the gasoline intake needle. The bowl is divided in half by a baffle plate, thus preventing excessive splashing of fuel.

b. Bowl Vent. The 553S carburetor uses a combination inside and outside bowl vent, and a vent stack tube. This vent stack is connected to a pipe which runs to the outside of the engine so that in the event of a flooding condition, the flooding fuel will be piped out of the "V" of the engine. However, this feature has been eliminated in the later production units. The 564S and 566S are "balanced" carburetors. Venting is accomplished by two vent tubes in the air horn. There is no outside vent used. This construction is shown in figure 47. The outside vent in the 553S in conjunction with the inside vent,



RA PD 310896

Figure 45 — Typical WCD Carburetor

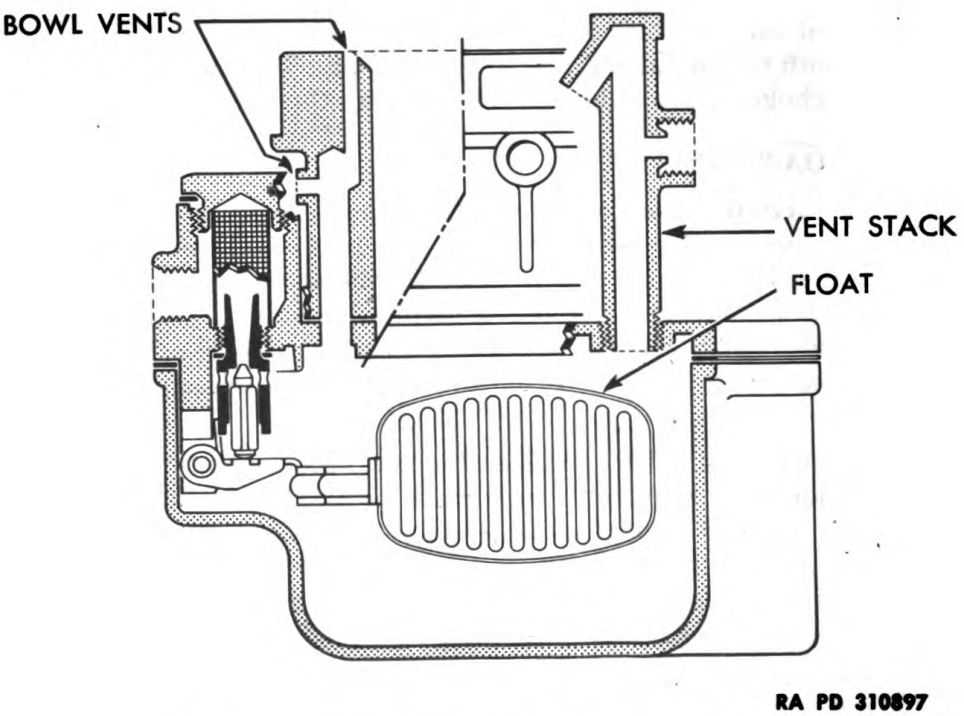


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Figure 46 — WCD Float Circuit (Early Type)

TYPE WCD CARBURETORS, MODELS 553S, 564S, AND 566S

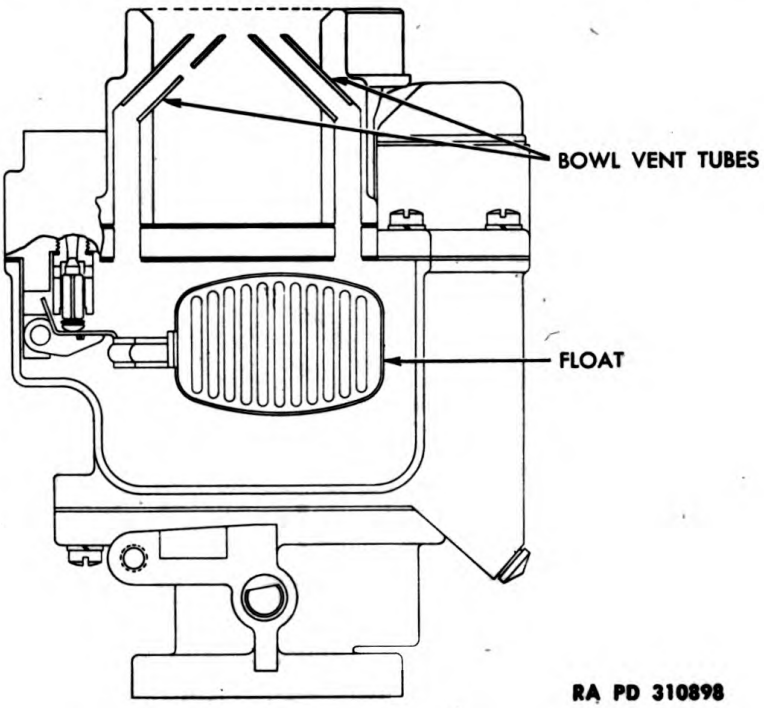

Figure 47 — WCD Float Circuit (Later Type)

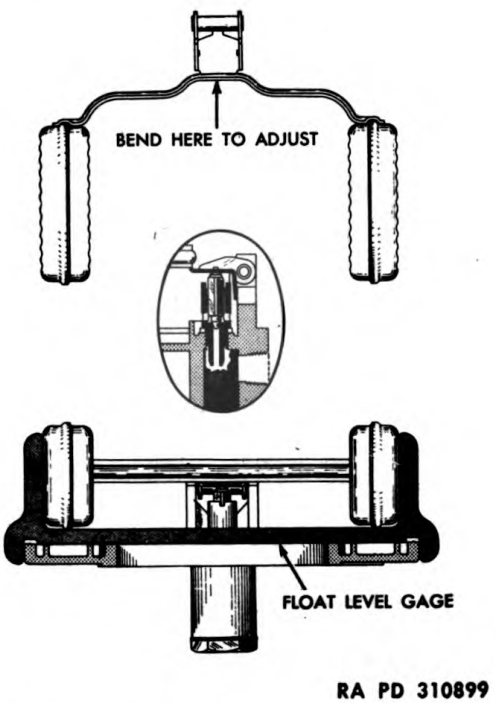

Figure 48 — WCD Float Adjustment

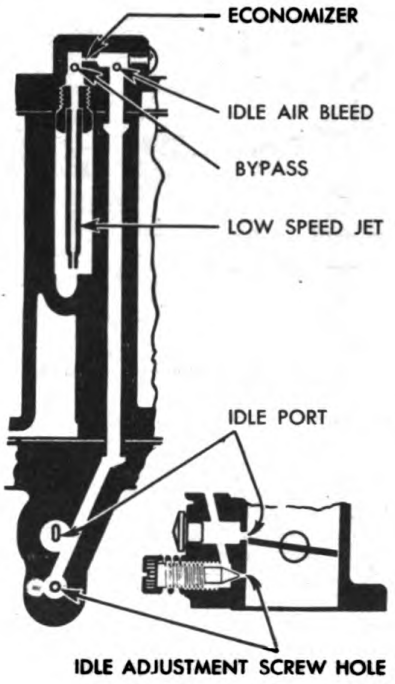

Figure 49 -- WCD Low Speed Circuit

and the small hole in one of the vent tubes in the 564S and 566S carburetors have the same effective purpose; in either case, a current of air is allowed to circulate through the bowl of the carburetor and in this way, sweep all fumes from this area, which aids in eliminating difficulty in starting while hot.

c. Float Setting. The correct method of checking the float is shown in figure 48. The gage illustrated permits accurate adjustment of bowl float bodies, both as to height and alinement. For proper adjustment each float body must clear the horizontal cross bar of the gage by no more than $\frac{1}{64}$ inch. The sides of the float bodies should just touch the uprights of the gage. Adjustment for level can be made by bending the cross bar of the float at the center adjacent to the float hinge.

85. LOW SPEED CIRCUIT.

a. Function. As stated, two separate idle circuits are used, one for each throat. They are identical in all respects. The fuel from the bowl enters the idle well after passing through the metering rod jet in the high speed circuit. The fuel is metered as it passes through the calibrated hole in the bottom of the low speed jet, rises up through the low speed jet to the passage in the bowl cover. At this point, air is admitted to the idle circuit through the bypass hole. The resulting

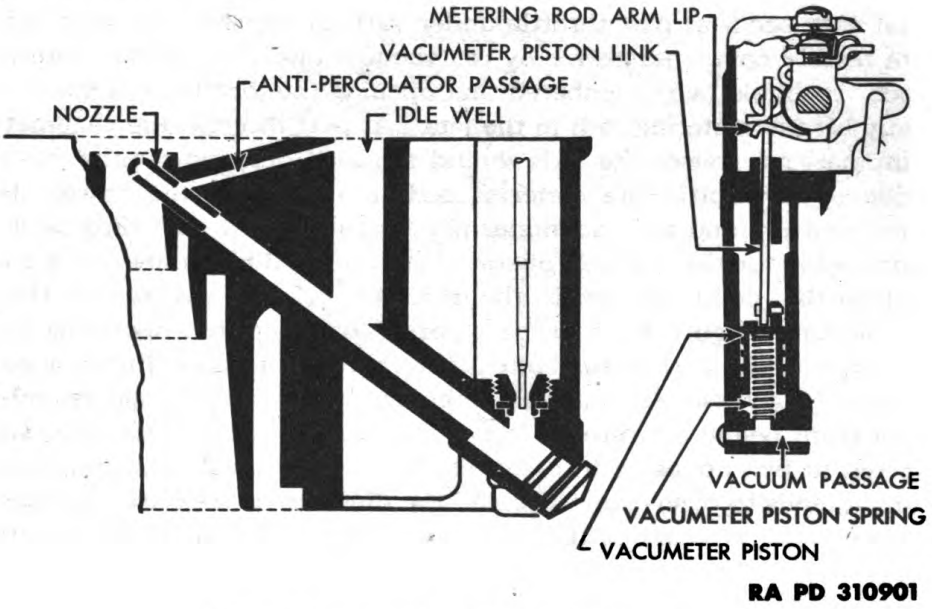

Figure 50 — WCD High Speed Circuit

mixture of fuel and air passes through the economizer, a restriction in the cross passage, after which an additional amount of air enters through the idle bleed hole (adjacent to the bypass hole). This mixture flows down the passage terminating at the idle port and idle adjustment screw hole. In operation, the bulk of the idle circuit mixture is discharged from the idle port. An additional amount, adjusted to the engine's needs, is discharged through the idle adjustment screw hole. Tightening the screw decreases the volume of the mixture discharged, and vice versa.

86. HIGH SPEED CIRCUIT.

a. Function. It should be remembered that the WCD carburetor contains two identical high speed circuits. Fuel is metered to these circuits from the bowl through the calibrated orifices provided by the metering rod jets and the metering rods within them. From these points the fuel flows through passages to the nozzles which protrude into the smallest venturis in the air horn. At idle, when the fuel level in the carburetor bowl is correct, the level of fuel in the nozzles is at a point below the lower hole in the nozzle tip.

b. Vacuum Controlled Metering Rods. These carburetors contain a "vacumeter" device which operates the metering rods. The metering rod position is controlled by both the linkage and by manifold vacuum, which automatically compensates for varying load conditions. Such construction has always been found particularly advantageous when automatic transmissions are used. The load variations

that may occur at part throttle under various transmission gear ratios are readily compensated for by the vacuum operation of the metering rods. It should be remembered that opening the throttle will mechanically lift the metering rods in the jets. At part throttle, the vacumeter automatically raises the rods should the load demand require it. At wide open throttle the metering rods are lifted to the power step mechanically and the vacumeter is inoperative. At part throttle it is impossible for the vacuum operated piston and link to lower the rods below the point to which the throttle linkage has raised them. As shown in figure 50, there is a spring-loaded piston operating in a cylinder in the carburetor body. The bottom of this cylinder is connected by a passage through the main body and body flange assembly to a point below the throttle valves. Thus the vacuum piston is subjected to two opposing forces: the force of the vacuum piston spring which tends to push it upward, and the differential pressure that exists between the pressure in the carburetor throat and the pressure in the manifold which tends to push the piston downward. At part throttle, when the load demand on the engine is light, the manifold vacuum will be high and the difference between the manifold vacuum and the pressure in the bowl will cause the vacuum piston to be held down against the stop on the mechanical linkage. Conversely, when the load demand is great at part throttle, manifold vacuum will be low and the vacuum piston spring will raise the vacumeter piston and link, to which the metering rods are attached.

c. Antipercolator Device. The top hole in the nozzle is an air bleed hole which permits air to mix with the fuel before it is discharged from the nozzle. The sloping passage (see fig. 50) from the idle well to the nozzle provides a means of preventing "percolation". Under normal operating conditions, all points within the nozzle, high speed passage, antipercolator passage, and idle well are subjected to the same pressure. However, at closed throttle, this passage acts as a vent to the idle well, and the nozzle passage below the well, by allowing fuel vapors to bleed out of the upper hole in the tip of the nozzle. Hence, no fuel can be forced out of the nozzle as a result of internal pressures.

d. Nozzles. CAUTION: *The nozzles must never be removed from the main body under any circumstances.* The nozzles have been pressed into place and if once removed, there is no method by which they can be reinstalled without special jig fixtures.

87. PUMP CIRCUIT.

a. Function. The pump circuit is illustrated in figure 51. As the throttle is closed, the linkage raises the plunger assembly toward the top of the pump cylinder. On this stroke of the pump, a quantity of fuel from the bowl flows through the ball check in the bottom of

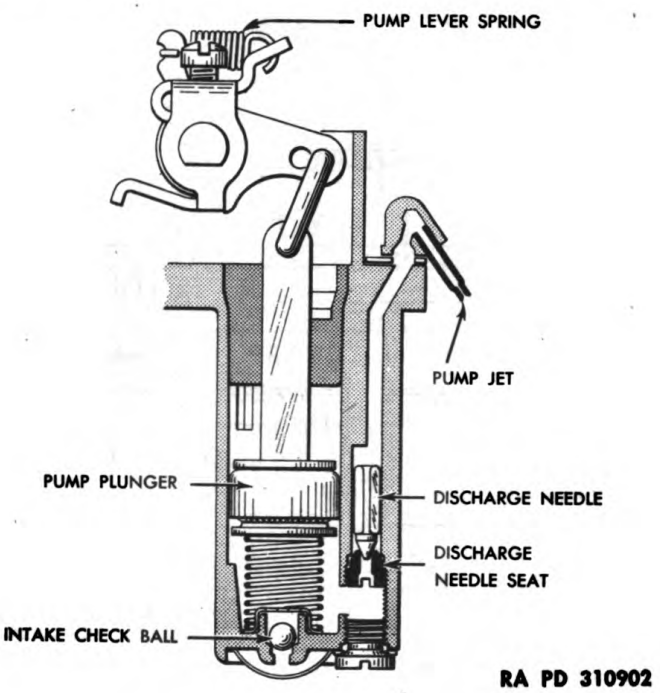

Figure 51 — WCD Pump Circuit

the pump cylinder. At this time the discharge check needle is on its seat, preventing air from entering the pump circuit through the pump jet. When the throttle is opened, the linkage forces the plunger down, and the fuel beneath it is pushed out of the pump cylinder into the passage containing the discharge check needle. The pressure forces the check needle off its seat and the fuel flows up the passage to the pump jet where it is divided, and an equally metered quantity is discharged into each throat of the carburetor. When the throttle is closed again, the pump cylinder is filled as before.

b. Delayed Action. It is necessary to provide a delayed action for the discharge of fuel from the pump circuit. This is achieved by the pump lever spring, which connects the pump arm and collar assembly to the pump operating lever and countershaft assembly. When the throttle is opened, the linkage drives the plunger through the pump lever spring. This provides the continued discharge from the pump circuit over the necessary time interval.

88. CHOKE CIRCUIT OR CLIMATIC CONTROL.

a. Description. The operation of the Carter climatic control choke is dependent upon three factors: heat, intake manifold vacuum, and the velocity of air passing through the air horn. The choker valve, located in the air horn, is mounted off-center on the choker shaft. On

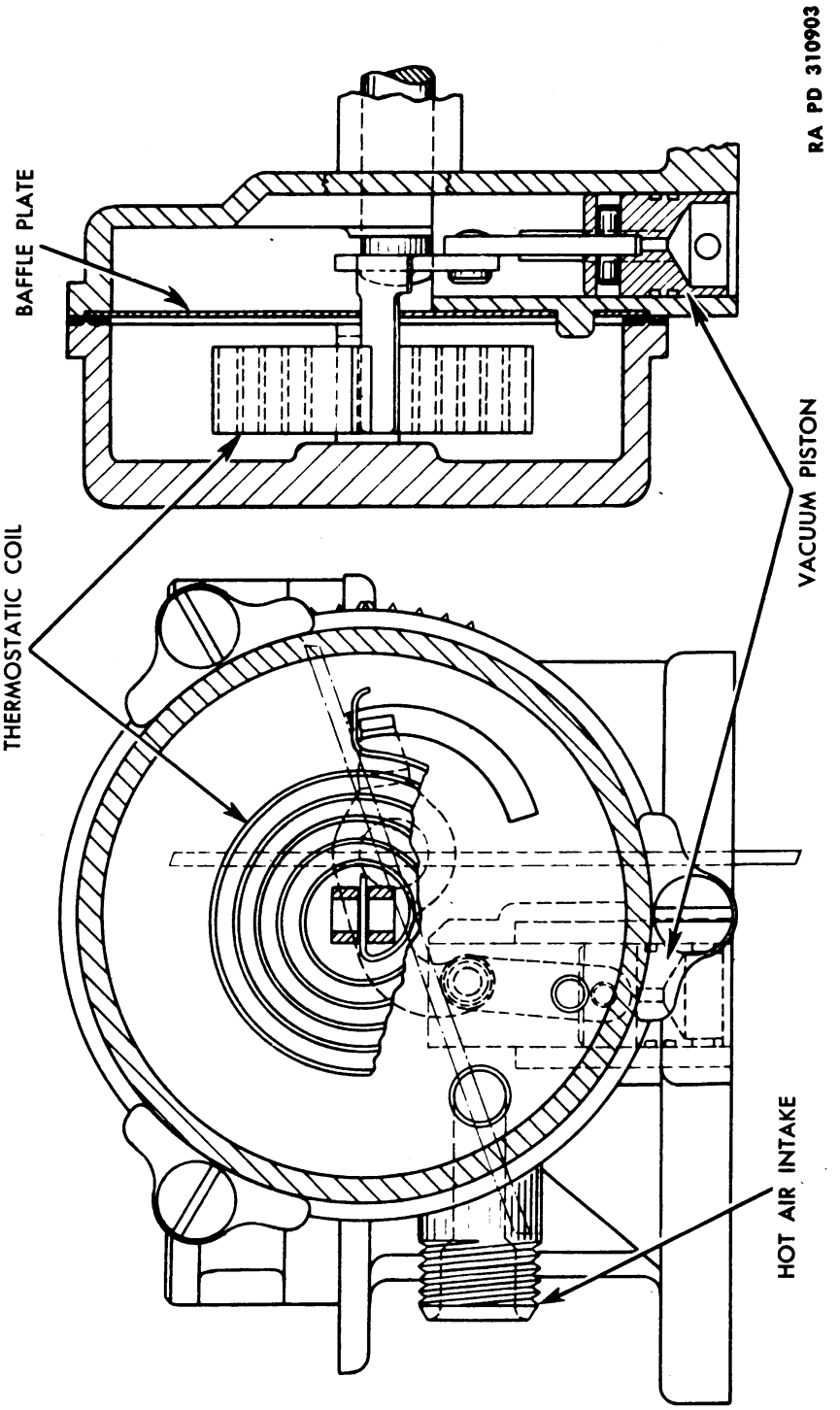

Figure 52 — Climatic Control Choke

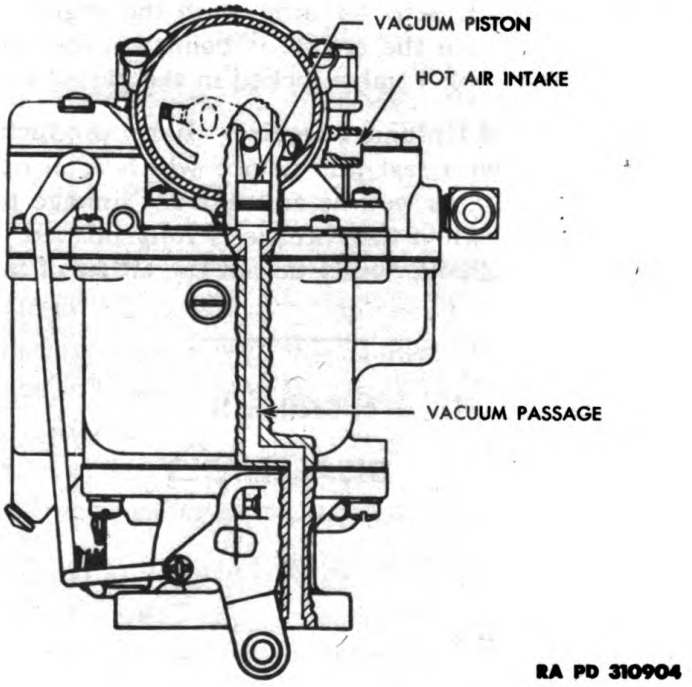

Figure 53 — WCD Climatic Control

the end of the choker shaft, which extends into the choke housing, there is a lever which is hooked to the outer end of a coiled thermostatic spring fastened to the choke cover. Also attached to this choker shaft lever is a vacuum piston which operates in the cylinder connected by a passage to a point below the throttle valve (see figs. 52 and 53). The choke housing is connected by a pipe to a stove on the exhaust manifold. A circulation of air from the stove through the choke housing, to the low pressure point below the throttle valves, is made possible by two vertical slots in the vacuum piston cylinder. As the engine warms up, the warm air from the manifold stove causes the thermostatic spring to lose its tension and release the choke. A baffle plate in the choke housing minimizes the accumulation of carbon around the moving parts of the choke.

b. Operation. When the engine is cold, the thermostatic spring holds the choker valve closed. When the engine is started, the differential pressure applied to the choke piston tends to open the choker valve against the tension of the thermostatic spring. Also, the weight of the offset choker valve, plus the air pressure on the valve, tends to open the choke. Therefore, under varying load conditions during warm-up, the position of the choker valve will be changed by the operation of the vacuum piston working against the thermostatic spring, and the air velocity in the air horn. It should be noted that

the choker valve is free to "breathe" with the engine at all times, including the time when the engine is being cranked with the starter. At no time is the choker valve locked in the closed position.

c. Fast Idle and Unloader Device. Early production carburetors (model 553S) have a fast idle device which is in operation during the warm-up period, as well as an unloader linkage to mechanically open a cold choke when the throttle is fully opened. Later production units (models 564S, 566S) do not use either of these devices.

Section II

DISASSEMBLY

89. DISASSEMBLY.

a. Remove and Disassemble Air Horn and Climatic Control Assembly. Remove air horn and all attached parts. Remove thermostatic coil housing cover, gasket, and baffle plate. Remove choke valve screws and valve, and slide shaft from air horn. If unit that is being reoperated is model 553S, remove choker lever and fast idle connector rod before removing air horn, then proceed as outlined.

b. Remove and Disassemble Bowl Cover. Remove bowl cover with all parts attached. Then remove float assembly and pin, needle and seat, bowl cover gasket, pump jet cluster, low speed jets, vacumeter piston, link, and metering rods. Loosen metering rod operating lever set screw, then slide pump countershaft from bowl cover. Remove pump link and plunger guide lock screw, then remove plunger guide, plunger assembly and spring. Remove bowl nut and strainer gauze. Remove pump discharge passage plug, discharge needle seat and needle. Remove pump intake check ball retainer and ball from bottom of pump cylinder. Note that most parts are installed in the bowl cover in these units.

c. Remove and Disassemble Throttle Body. Remove throttle body from main casting. Remove both idle adjusting screws, springs and idle port plugs. Remove throttle valves. Remove throttle centering screw. Slide throttle shaft from casting.

d. Disassemble Body Casting. Remove metering rod jets and vacumeter piston spring. CAUTION: *Do not remove nozzles.*

TYPE WCD CARBURETORS, MODELS 553S, 564S, AND 566S

Section III

CLEANING, INSPECTION, REPAIR, AND ASSEMBLY

90. CLEANING AND INITIAL INSPECTION.

a. Main Body Casting. Soak castings for a short time in dry-cleaning solvent, then blow out with compressed air. All passages must be clean. Be sure that nozzles have not been damaged. Check shoulders for damage where metering rod jets seat.

b. Throttle Body. After cleaning as outlined in subparagraph **a**, remove all carbon deposit from the throat where throttle valves seat. All carburetors are subject to this deposit after prolonged low speed operation. Wet or dry sandpaper aids greatly in removing this deposit. Blow out passages with compressed air.

c. Air Horn Casting and Bowl Cover. Soak castings as outlined in subparagraph "**a**," then blow out with compressed air. Check for carbon accumulation in climatic control cylinder slots in air horn. Check shoulders where all jets seat in bowl cover.

d. Small Parts. Soak small parts in dry-cleaning solvent and dry with compressed air. Parts which are to be replaced, such as those listed below, need not be cleaned. When the carburetor is completely overhauled, the installation of a repair parts package is recommended and includes the following parts: low speed jets, needle and seat assembly, plunger, metering rods and jets, throttle connector rod, pump, intake ball, and all necessary gaskets, springs, retainers, screws and rivet passage plugs.

91. CIRCUIT SERVICE METHOD.

a. The overhauling of carburetors by the Circuit Service Method is the simplest way. By grouping the parts, and the installation of such parts in groups, it will be found that each group can be installed completely before proceeding to the next group. It is suggested that the

serviceman use a sectionalized pan or muffin tin to separate each group of parts.

92. INSPECTION, REPAIR, AND ASSEMBLY OF LOW SPEED CIRCUIT PARTS.

a. Service Requirements. Both idle circuits in the carburetors must receive identical service. The low speed jets must be clean and screwed tightly into the bowl cover. The bypass and idle air bleed holes must be absolutely clean. The passages of both circuits must be clean. There must be no air leaks in the passages. The use of a new gasket on the bowl cover, and between the main body and the body flange, each time the carburetor is assembled, will preclude this possibility. The carburetor bores must be free from carbon around the throttle valves. The throttle valves must be properly installed, with their stamped trademarks facing the idle ports and the mounting flange face. The throttle shaft and throttle valves must be free from damage or wear to insure good low speed operation.

b. Assembly. Group all parts controlling the low speed circuit, namely: throttle shaft, valves and screws, throttle centering screw, idle adjusting screws and springs, idle port plugs, and low speed jets. Slide throttle shaft into place and install throttle centering screw. Install throttle valves with small "c" in circle toward idle ports when viewing casting from manifold side. Center throttle valves by tapping lightly and hold in place with fingers before tightening screws. Always use new screws. Install idle port rivet plugs, then idle adjustment screws and spring. Install low speed jet assemblies (no gaskets are used under low speed jets).

93. INSPECTION, REPAIR, AND ASSEMBLY OF PUMP CIRCUIT PARTS.

a. Service Requirements. The pump lever spring must be undamaged to secure proper delayed action. The plunger leather must be pliable and undamaged and the spring beneath the leather must be clean and undistorted. The pump linkage must be free from backlash so that the pump plunger moves as soon as the throttle is opened. The plunger spring in the pump cylinder should never be altered in any way. The pump intake check ball and its seat, and the pump check needle and its seat, must be clean and not worn. The discharge pump check plug, which is the seat for the pump check needle, must be screwed tightly into its passage and sealed around its tapered end so that fuel will not drain back from pump jet when the throttle is closed. Both pump jets must be clean and the housing must be fastened tightly to the bowl cover with the two attaching screws. The large air horn gasket between the bowl cover and the pump jet housing must be undamaged and the holes through it must be unrestricted.

b. Assembly. Group all parts controlling pump operation, namely: pump plunger, plunger guide and lock screw, pump spring, intake check ball and retainer, pump strainer, discharge needle, seat, discharge passage plug, and pump jet cluster. Install air horn gasket, then pump jet cluster on bowl cover. Install pump discharge needle (blunt end first), discharge check plug, then discharge passage plug. Install intake check ball and retainer. Use sleeve from tool T109-122U to put cap firmly in position. Install pump plunger spring, plunger, and plunger guide. Install screw to securely lock guide in place. Install pump strainer (on lower end of pump cylinder).

94. INSPECTION, REPAIR, AND ASSEMBLY OF FLOAT CIRCUIT PARTS.

a. Service Requirements. The bowl must be effectively sealed with a new gasket. The floats must not be loaded, damaged, or worn. The floats must be carefully set with proper gage to insure correct fuel level and to preclude the possibility of either float body rubbing against the carburetor casting when the bowl cover is installed. The needle valve and seat must be clean and not worn. Scum or "varnish" on the needle indicates presence of gum in the fuel.

b. Assembly. Group all parts controlling fuel level, namely: bowl strainer and nut, bowl cover gasket, needle and seat assembly, float assembly, and pin. Press strainer gauze into nut and install assembly in bowl cover. Install needle and seat assembly. Install float assembly and pin but do not install bowl cover gasket until after float has been set.

c. Float Adjustment. The floats must be carefully set with the proper gage to insure correct fuel level and float alinement. Figure 48 shows how this adjustment must be made. For proper adjustment, each float body must clear the horizontal cross bar of gage by no more than $\frac{1}{64}$ inch. The sides of the float bodies should just touch the uprights of the gage. Adjustment can be made by bending the cross bar of the float at the center adjacent to the float hinge. Carefully remove float assembly and install bowl cover gasket. Then reinstall float assembly and pin.

95. INSPECTION, REPAIR, AND ASSEMBLY OF HIGH SPEED CIRCUIT PARTS.

a. Service Requirements. All passages must be clean. CAUTION: *The nozzles must never be removed from the main body under any circumstances.* When the carburetor is overhauled, new metering rods and jets should be installed because visual inspection may not reveal the wear that has taken place. The metering rod disks must be free on the metering rods and provide an effective air seal at the metering rod holes in the bowl cover. The metering rod spring must be connected to the metering rods. The dust cover over

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the metering rod linkage must be sealed with a new gasket. The vacuum piston spring must not be damaged and must be the exact one specified. The vacuum piston must not be worn for an air leak at this point would permit the vacumeter device to raise the metering rods sooner than required. The metering rods must be properly gaged or delivery of fuel by the high speed circuit will be incorrect throughout the entire speed range.

b. Assembly. Group all parts controlling the high speed circuit, namely: metering rods and jets, vacumeter piston link and metering rod spring, pump arm and collar assembly, metering rod arm and screw assembly, pump arm spring, pump countershaft, pump link, vacumeter piston and spring, throttle connector rod and retainers.

Assemble body flange assembly to body casting, using a new gasket. Install metering rod jets. Install vacumeter piston link and metering rod spring in bowl cover. Start to install pump countershaft assembly, but push shaft into place only until end can be seen entering the box-like portion of bowl cover where vacumeter piston link is located. Then hold pump arm and collar assembly, metering rod arm and screw assembly, and pump arm spring in position, and work the shaft into place with a twisting motion. When shaft has fully entered, install keeper on protruding end of shaft and tighten lock screw of metering rod arm. Install pump link. Hold vacuum piston link in place and invert bowl cover assembly. Install vacuum piston on link and insert vacuum piston spring in hollowed portion of piston. While holding bowl cover in its inverted position, invert main body casting and lower gently into place over bowl cover. Install bowl cover screws and lock washers. Check to see that piston and link is free in cylinder by pushing up and down with finger. Install throttle connector rod and back out throttle lever adjusting screw so throttle valves seat in bore.

96. PUMP TRAVEL ADJUSTMENT.

a. Pump travel is the vertical distance the plunger and rod assembly travels, from fully closed throttle, to wide open throttle. Procedure is as follows:

(1) Back out throttle stop screw in throttle lever and hold throttle in fully closed position.

(2) Invert pump stroke gage (41-G-256) on the edge of the dust cover boss and hold in vertical position as shown in figure 54.

(3) Turn knurled nut on gage until projecting finger rests on top of lower portion of pump link.

(4) Remove gage and observe figure closest to the index mark on beveled edge of knurled nut.

(5) Open throttle wide and again check the height of the plunger with the gage, measuring to the top of the lower portion of the pump link as before.

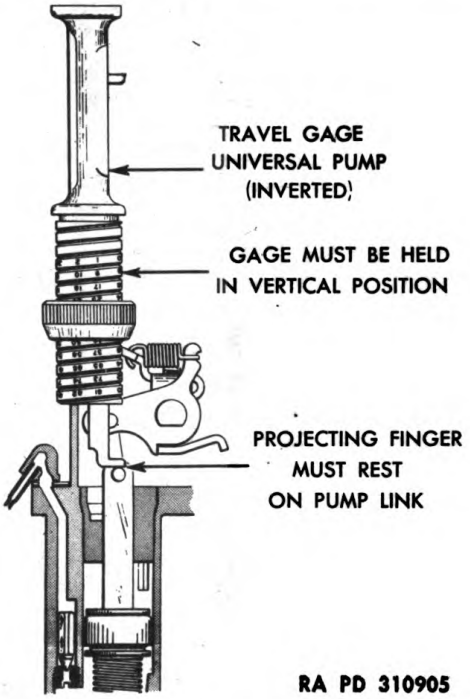

Figure 54 — WCD Pump Adjustment

(6) Observe the closest figure indicated on the gage as before.

(7) Subtract the fully closed throttle reading from the wide open throttle reading, thus obtaining the pump travel in 64ths of an inch.

(8) Consult specification sheet for exact pump travel. A tolerance of $\frac{1}{64}$ inch either way is allowable.

(9) To change the pump travel, bend the throttle connector rod at the lower angle next to the throttle lever. Shortening the connector rod, by so bending, lengthens the pump stroke, lengthening it decreases the pump stroke. CAUTION: *Pump travel must be adjusted before metering rod adjustment is performed.*

97. METERING ROD ADJUSTMENT.

a. The metering rods must be properly gaged or delivery of fuel by the high speed circuit will be incorrect throughout its entire range. Metering rod adjustment must be performed after pump adjustment has been made. Procedure is as follows:

(1) With one metering rod removed, install one metering rod gage T109-163 in the metering rod hole in bowl cover, seating the tapered end in metering rod jet.

(2) Hold throttle in fully closed position. (Throttle stop screw backed away from stop.)

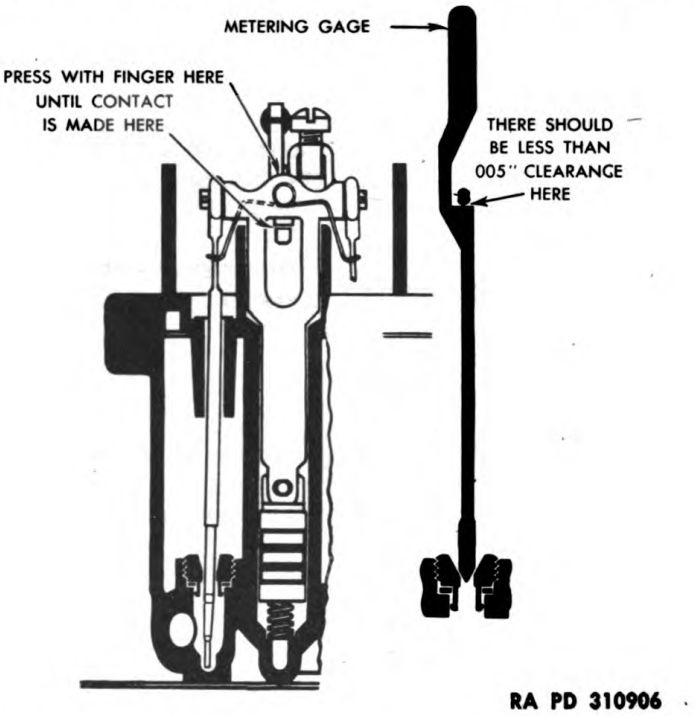

Figure 55 — WCD Metering Rod Adjustment Using Gage T109-163

(3) Press vacuum piston link down to the lip on the metering rod arm and the screw assembly which acts as a stop for the piston link (fig. 55).

(4) Metering rod gage should be free but there should be less than 0.005-inch clearance between the shoulder of gage and the metering rod pin on the vacuum link.

(5) Adjust if necessary by bending the lip on metering rod arm.

(6) Regage. CAUTION: *Metering rod gaging must be performed only after pump travel has been adjusted.*

(7) Install metering rod dust cover and gasket.

98. INSPECTION, REPAIR, AND ASSEMBLY OF CHOKE CIRCUIT PARTS.

a. Service Requirements. Choker shaft, valve and vacuum piston must operate freely. With the thermostatic coil and housing removed, the choker should, of its own weight, drop to the wide open position. The two slots in the vacuum piston cylinder must be free of all carbon deposit. The two small holes in the bottom of skirt of the vacuum piston must be clean. The vacuum passage through the bowl cover, main body and the body flange assembly of the carburetor must be unrestricted and must not leak air through any of the

gaskets. The hot air pipe should be firmly attached to the air horn, unrestricted and properly inserted in the stove. The thermostatic coil must not be removed from the housing and the coil and housing are always serviced as an assembly. A gasket is used between the coil housing and the air horn and should be replaced, each time the choke is assembled, to prevent air leaking into the choke housing at this point.

b. Assembly. Group all parts controlling the choke circuit, namely: choker shaft, valve and screws, piston and pin, baffle plate, coil and housing assembly, retainers and screws. Install air horn on body casting. Install piston on choker shaft and lever assembly and slide shaft into place. With piston over cylinder, revolve shaft so as to lower piston into cylinder. Install choker valve, using new screws. Seat choker valve by tapping lightly and hold in place with fingers before tightening screws. Valve or shaft must not bind in any position. Install baffle plate and coil housing gasket. Install thermostatic coil and housing assembly as follows:

(1) Hold the thermostatic coil and housing assembly firmly against the choke housing of the air horn with the hooked end of the thermostatic coil 180 degrees from the lever on the choke shaft.

(2) Rotate the thermostatic coil housing 180 degrees.

(3) Line up the index mark on the thermostatic coil and housing assembly with the center index mark on the choke housing. Fasten in position with the three screws and retainers.

(4) On Models 564S and 566S, there are two index marks on the thermostatic housing as well as the choke housing on the air horn. When the thermostatic housing is properly installed the center index mark on the top of the choker assembly and the index mark on the side of the choker housing will register with the two marks on the thermostatic coil housing assembly.

c. If unit being serviced is 553S, install choker lever and screw assembly and fast idle connector rod. Then install fast idle cam assembly and make unloader and fast idle adjustments as follows:

(1) UNLOADER ADJUSTMENT. Two adjustments are necessary to get correct unloader setting. Loosen choker lever and screw assembly on shaft. Insert 0.010-inch flat feeler gage between lip on fast idle cam and boss on flange casting. Hold choker valve closed and tighten choke shaft arm. Then adjust unloader lip on throttle shaft lever to give $\frac{3}{16}$-inch clearance between upper edge of choke valve and inner wall of air horn with throttle wide open.

(2) FAST IDLE ADJUSTMENT. With choker valve tightly closed, adjust fast idle set screw to give 0.020-inch clearance between throttle valve and bore of carburetor (side opposite idle port).

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CHAPTER 9

T-SERIES TANK CARBURETORS AND MODEL ETW1 CARBURETORS (BALL AND BALL DOWNDRAFT WITH BUILT-IN GOVERNORS)

Section I

DESCRIPTION

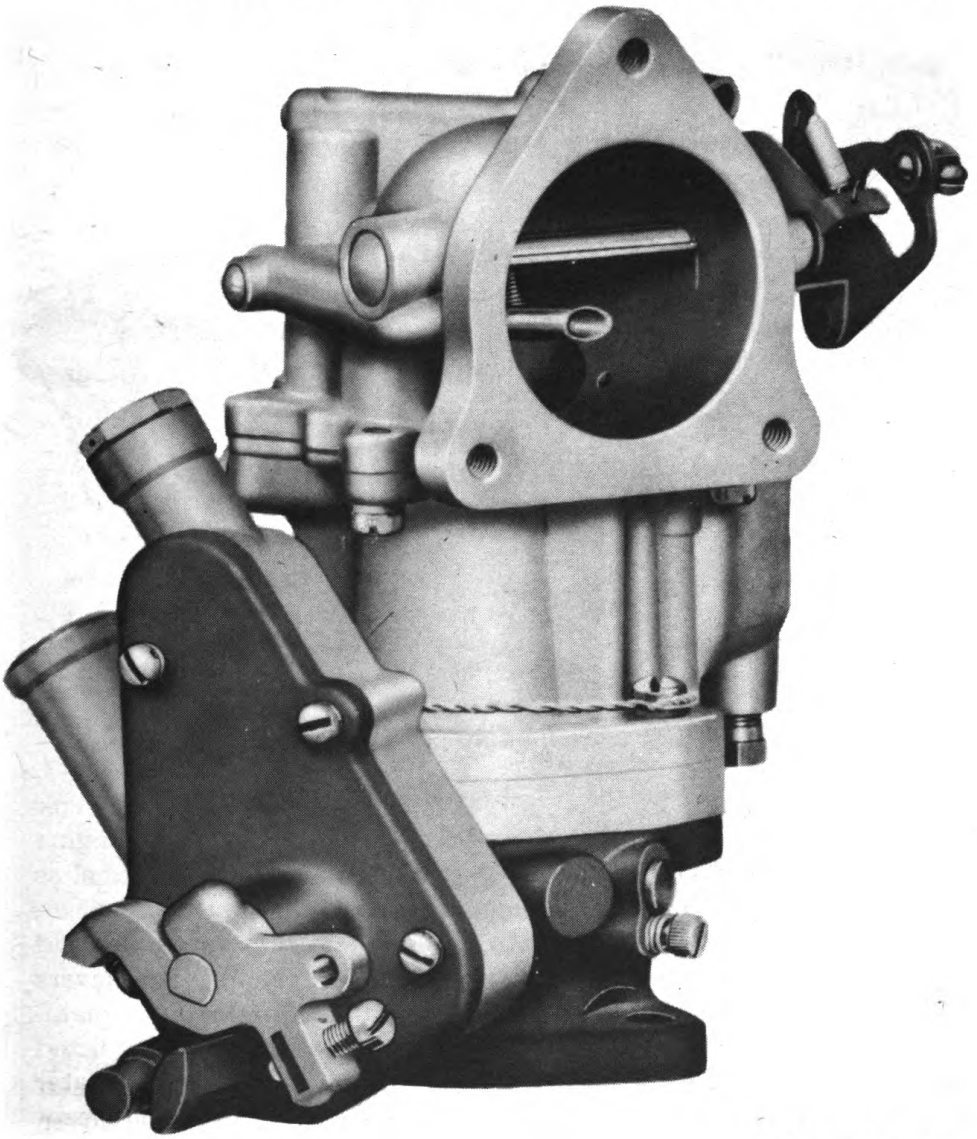
99. SCOPE.

a. These carburetors bear model Nos. T1-A, T2-A, T3-A, T4-A, T5-A, T1B, T2B, T3B, T4B, T5B, TD1, TD2, TX-1, TX-2, TX-3, TX-4, TX-5, 561S, 577S, and ETW1. They are used on Medium Tank M4A4, Cargo Carriers M28 and M29, and Dodge trucks with engine models T-214 and T-223. All carburetors of this type are identical as to basic design, construction, and service requirements; however, throttle levers and choke levers vary, depending on which manifold the individual carburetor is used. The throttle levers and choker levers on the late production tank carburetors are the same for each manifold. Early production carburetor main body castings are not fitted with a built-in filter element, whereas the filter is incorporated in later models. All carburetors contain the built-in speed governor except the 561S and 577S units. The air horn on the ETW1 is different, due to air cleaner manifold construction. However, the five circuits are identical.

100. FLOAT CIRCUIT.

a. Function. A schematic drawing of the float circuit of these carburetors is shown in figure 59. Fuel is admitted through the needle seat into the fuel bowl in the main body. The bowl has a center section which acts as a baffle plate to eliminate the splash of gasoline; consequently, the float is divided into two separate sections, although both are used in the same bowl. As the fuel rises, the float closes the needle valve at the proper fuel level. This proper fuel level is controlled by

T-SERIES TANK CARBURETORS AND MODEL ETW1 CARBURETORS (BALL AND BALL DOWNDRAFT WITH BUILT-IN GOVERNORS)



RA PD 310907

Figure 56 — ETWI Carburetor

the setting of the float. These Carter carburetors all employ what is called a "balanced" or inside bowl vent and is accomplished by a tube which projects into the carburetor air horn beyond the choker valve.

101. LOW SPEED CIRCUIT (fig. 60).

a. Function. Fuel from the carburetor bowl is pushed through the calibrated hole at the bottom of the idle orifice tube which extends into the high speed passage. This metered fuel is carried to the idle

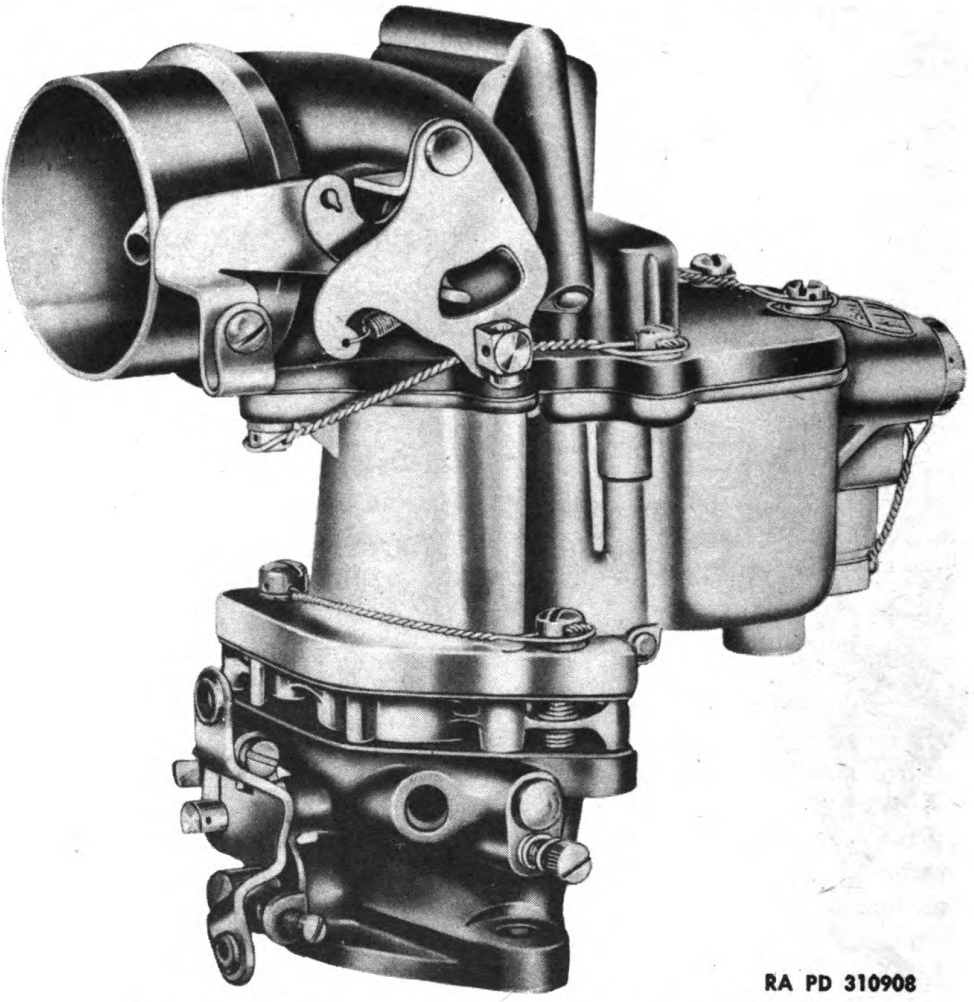


Figure 57 — Models 561S and 577S Carburetors

passage air bleed through a cross passage which can be clearly seen when the bowl cover is removed. The center part of the bowl cover gasket forms one side of this passage, therefore it must be air tight at all times or a lean low speed condition will result. The idle passage air bleed is a small brass bushing pressed into the air horn directly above the economizer. The fuel and air then pass down through the economizer which not only accomplishes a more complete mixing of the fuel and air, but also limits the flow through the idle circuit. This fuel mixture passes down the remainder of the idle passage where it is discharged from the idle port and the idle adjusting screw hole into the low pressure air stream below the throttle valve. As on other types of Carter carburetors, a leaner mixture is obtained by turning the idle adjustment screw in, and conversely, backing out the idle adjustment screw will produce a richer idle mixture.

T-SERIES TANK CARBURETORS AND MODEL ETW1 CARBURETORS (BALL AND BALL DOWNDRAFT WITH BUILT-IN GOVERNORS)

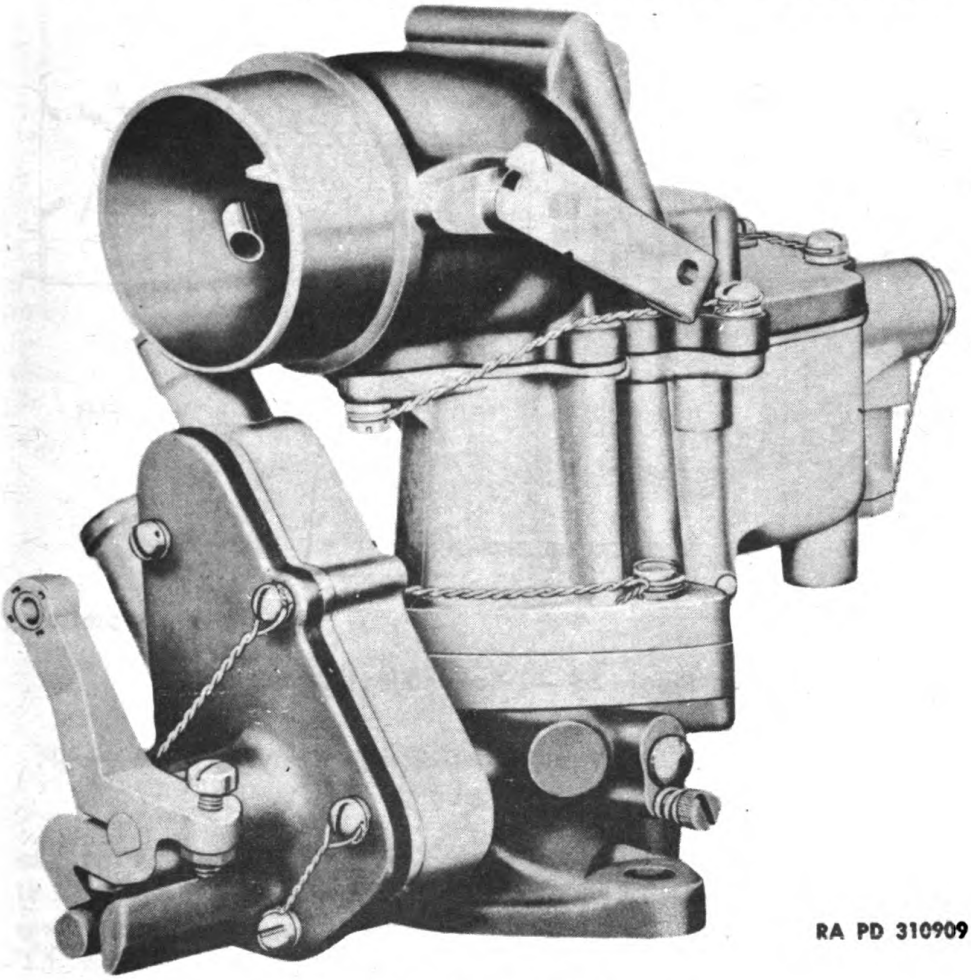


Figure 58 — T-Series Carburetor

102. HIGH SPEED CIRCUIT.

a. Function. Fuel which is metered through this part of the high speed circuit, takes care of the light load demands of the engine throughout the part throttle range. Fuel from the bowl is pushed through the main metering jet and flows up through the passage to be discharged into the air stream. The high speed passage travels upward and across the upper part of the body casting instead of diagonally upward into the diffuser port of the air foil. The main vent tube assembly is installed in the vertical portion of this passage and the plug seals at the upper surface of the bowl cover. It is very necessary that no leak is allowed at this point (in the center of the bowl cover), as it will act as an outside vent to the bowl and at the same time allow air to bleed through the threads to the high speed passage. This will affect the entire high speed range. This vent tube provides a means

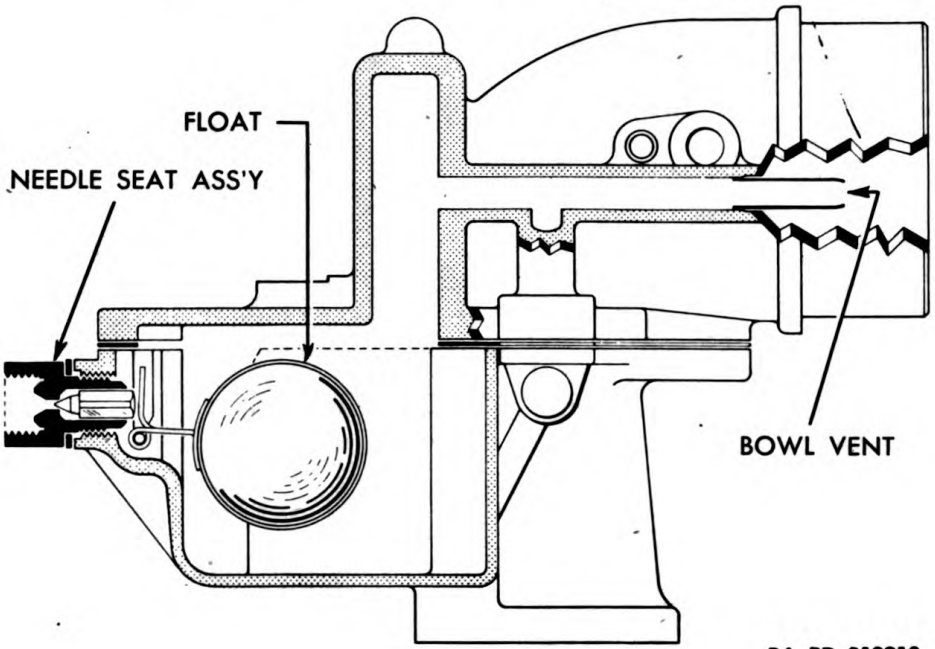


Figure 59 — T-Series Float Circuit

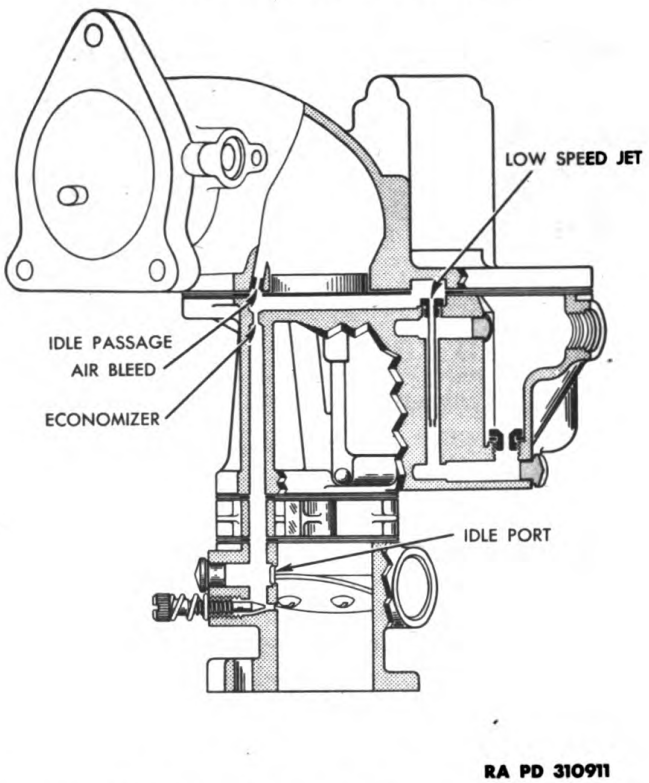
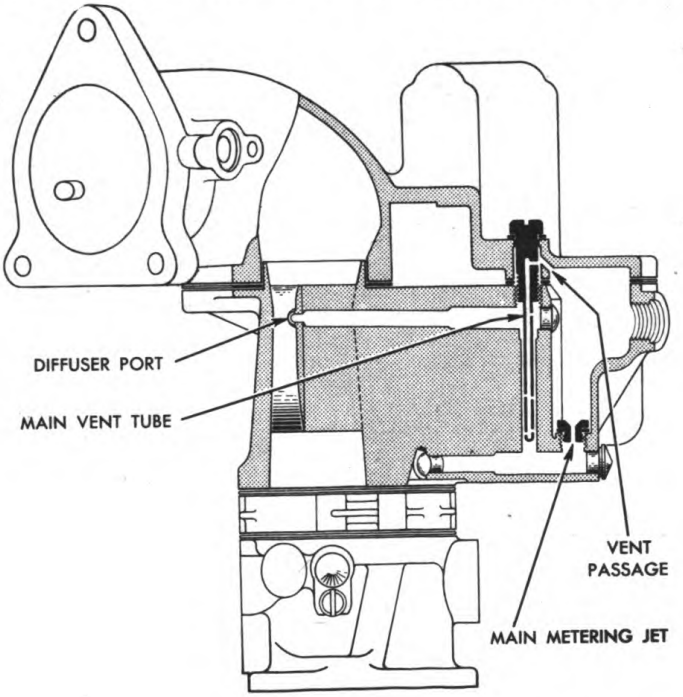


Figure 60 — T-Series Low Speed Circuit (Model ETW1)

T-SERIES TANK CARBURETORS AND MODEL ETW1 CARBURETORS (BALL AND BALL DOWNDRAFT WITH BUILT-IN GOVERNORS)



RA PD 310912

Figure 61 — T-Series High Speed Circuit (without Vacuum Step-up) (Model ETW1)

of premixing air with the fuel before it is discharged into the throat of the carburetor. Air from the bowl, which is admitted through the main vent tube, enters through a small hole in the side of the plug. The tube is fitted with tiny calibrated holes and, through these holes, air is mixed with the fuel being discharged through the diffuser ports or "fish-eyes".

b. Vacuum Step-up System. When the throttle is at wide-open position, or when the load demand on the engine becomes excessive, it is necessary to provide an additional amount of fuel. This additional amount of fuel is controlled by the vacuum step-up device in the high speed circuit. Figure 62 shows the combined high speed circuit with vacuum step-up system, whereas figure 61 shows only the high speed circuit without the vacuum step-up device. This additional fuel flows through the same passage as the fuel from the main metering jet, and hence it, too, is discharged through the holes on either side of the diffuser bar. The flow of fuel through the step-up jet is controlled by a pointed rod inserted in the jet. This rod, called the step-up rod, is mounted on a narrow plate, which in turn is fastened to a vacuum piston operating in a cylinder adjacent to the step-up jet. Beneath the piston is the calibrated step-up spring which tends to lift the step-up

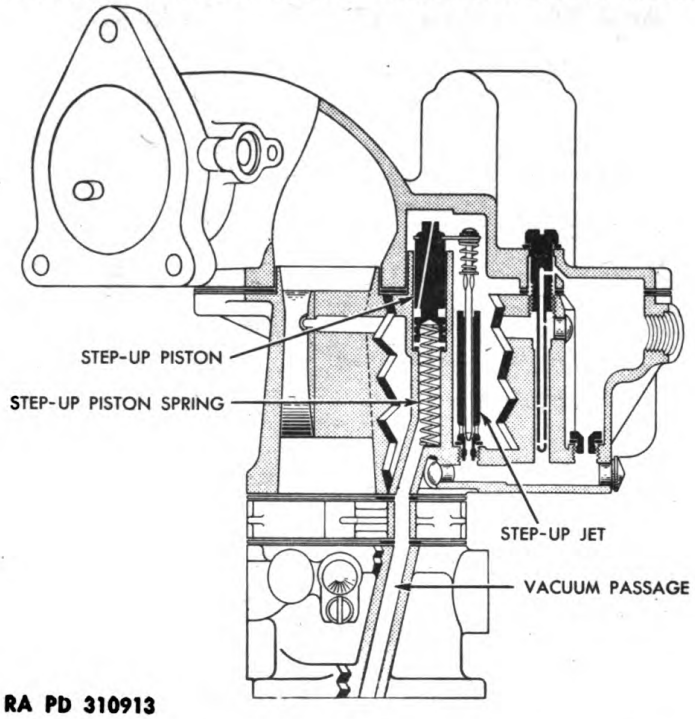


Figure 62 – T-Series High Speed Circuit (with Vacuum Step-up) (Model ETW1)

piston, and thus permit fuel to flow through the step-up jet. The step-up piston cylinder is connected by a passage to a point below the throttle valve. Thus the step-up piston is subjected to two opposing forces: the force of the step-up spring, which tends to push it upward, and the differential pressure, that exists between the pressure in the carburetor bowl, and the pressure in the manifold, which tends to push it downward. When the load demand on the engine is light, manifold vacuum will be high and the difference between manifold vacuum and the pressure in the bowl will cause the step-up piston to be held down against the tension of the spring; hence the step-up jet is closed. Conversely, when the load demand is great, regardless of throttle opening, manifold vacuum will be low and the step-up spring will raise the step-up piston plate and rod assembly, thereby permitting the additional fuel to enter the high speed circuit to take care of the load demand.

103. PUMP CIRCUIT (fig. 63).

a. Accelerating Pump. The accelerating pump supplies additional fuel for acceleration. The pump circuit of these carburetors differs from other Carter carburetors in that the pump plunger is controlled by a vacuum piston and spring. Manifold vacuum is connected

T-SERIES TANK CARBURETORS AND MODEL ETW1 CARBURETORS (BALL AND BALL DOWNDRAFT WITH BUILT-IN GOVERNORS)

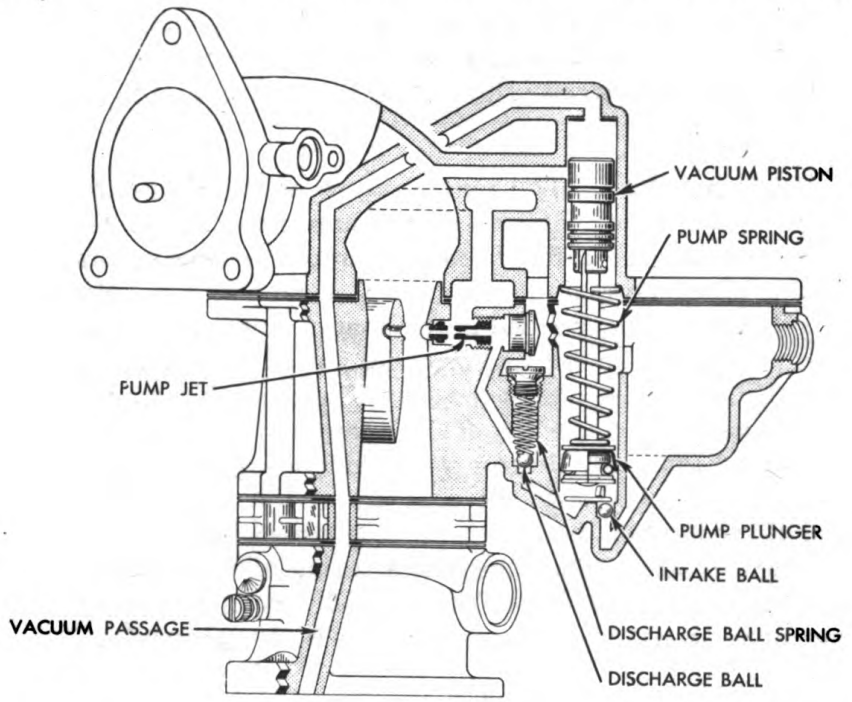


Figure 63 — T-Series Pump Circuit (Model ETW1)

by a passage (through the slotted flange gasket) to the air horn in which is located the vacuum cylinder. At closed throttle position, the difference in pressure in the bowl and the pressure in the vacuum cylinder raises the piston, with the plunger attached, against the tension of the pump spring. Fuel from the bowl of the carburetor flows into the pump cylinder through a passage in which is located the intake check ball. The discharge check ball in the passage adjacent to the pump cylinder, is held on its seat by the pump check spring and hence prevents air entering the pump circuit through the pump jet. When the throttle is opened, the difference in pressure between the bowl and the intake manifold is decreased. The pump spring, compressed between the bowl cover and the plunger, overcomes the differential pressure and pushes the plunger assembly downward. During the discharge stroke, the fuel pressure forces the intake check ball to its seat; the fuel is forced past the discharge check ball and out the pump jet.

b. Delayed Action. The accelerating pump used in this type of carburetor is called a "wet pump". The pump plunger leather with a small expanding spring under it, fits freely in the pump cylinder. This accelerating pump, as the name "wet pump" implies, functions without any air underneath the accelerating pump plunger. For its "delayed action", this pump circuit depends upon the pump spring, the expansion

of which continues the discharge of fuel for a brief period after a sudden opening of the throttle valve. This sudden opening of the throttle will cause the manifold vacuum to drop, thereby destroying the differential pressure which raised the pump piston against the pump spring tension.

c. Pump Relief. The pump circuit of these carburetors is not allowed to "bleed" or "pull-over". "Pump bleed" is the term used to describe the delivery of fuel from the pump jet during constant throttle operation above normal idle range. Inspection of the "balanced" vent passage, previously described in the float circuit, will reveal that it not only vents the bowl but it also provides a vent to the pump jet through a cross-drilling in the side of the jet. Therefore, it is obvious that the low pressure effect at the end of the pump jet is destroyed by connecting it to the bowl vent. In this way, a balance is achieved between the pressure in the bowl and the pressure at the end of the pump jet. Under this condition, no fuel can be delivered from the pump circuit at constant throttle. The pump check spring, which holds the discharge check ball on its seat, insures the non-delivery of fuel from the pump circuit under constant throttle operation in rough terrain.

104. CHOKE CIRCUIT.

a. Function. When the choke is used, the mixture is enriched by cutting down the amount of air admitted through the carburetor. A poppet valve is provided in the choker valve to allow inward relief and hence lessen the danger of over-choking the engine with raw fuel. The choke used on the ETW1, 561S and 577S uses an off-center choke valve in connection with a choke operation lever and spring. In choking position the spring action allows the choke to "breathe" with the engine, which lessens the sensitivity of the choke control.

105. SPEED GOVERNOR.

a. Function. The governor, used on all carburetors of this group except Models 561S and 577S, is connected directly to the carburetor throttle shaft and governs the maximum engine speed by controlling the position of the carburetor throttle valve. The governor works on the principle of air velocity against an off-center throttle valve. The cam on the throttle shaft revolves in a clockwise direction and stretches the spring as the throttle closes. The plunger, located in the opposite side of the governor housing, acts as a "dash-pot" or stabilizer to prevent throttle valve flutter. The balancing effect between the air velocity against the off-center valve, and the adjustable spring working against the cam action, allows the governor to become effective at almost any predetermined speed.

T-SERIES TANK CARBURETORS AND MODEL ETW1 CARBURETORS (BALL AND BALL DOWNDRAFT WITH BUILT-IN GOVERNORS)

Section II

DISASSEMBLY

106. DISASSEMBLY.

a. Remove and Disassemble Air Horn. Remove main vent tube and bowl cover attaching screws. Remove air horn and bowl gasket. Remove choke valve and slide choker shaft from casting. On Models 561S, 577S, and ETW1, it will be necessary to remove choke-tube bracket and spring before removing valve and shaft.

b. Remove and Disassemble Body Casting. Remove pump plunger assembly. Remove step-up piston assembly, step-up spring and gasket. Remove horse-shoe-shaped float pin retainer and float assembly. Remove needle seat assembly. Remove main metering jet and step-up jet. Remove low speed jet, discharge ball check plug, spring, and check ball. Remove intake check ball and retainer from bottom of pump cylinder. Remove pump jet rivet plug and pump jet. On carburetors containing the fuel filter as built-in feature, remove filter cap and filter.

c. Throttle Body and Governor Assembly. Do not attempt to service the governor. Remove only the cover plate when it becomes necessary to clean the governor with compressd air. The cover plate and housing must seal air tight at all times. The throttle valve is an intrical part of the governor, consequently, the throttle valve should not be removed except when it shows wear or damage. However, the carbon accumulation in bore of throttle body where throttle valve seats, must be removed to assure proper low speed performance. Remove idle adjusting screw and idle port plug. If governor is inoperative, the flange and governor assemblies should be replaced. A fast check to see whether or not governor is operative can be made by pushing throttle lever to closed position. If throttle does not spring open when lever is released, governor is inoperative and the entire flange assembly should be replaced An inoperative governor will not move the throttle valve even though throttle lever is moved to wide open position.

Section III

CLEANING, INSPECTION, REPAIR, AND ASSEMBLY

107. CLEANING AND INITIAL INSPECTION.

a. Body. Soak the casting for a short time in dry-cleaning solvent, then blow out with compressed air. All passages must be clean. Note particularly that shoulders where jets seat have not been damaged. Be sure to remove old step-up piston gasket.

b. Air Horn. Soak in dry-cleaning solvent and blow out with compressed air. Be sure that air bleed hole from bowl to vent tube passage is not restricted. Idle passage air bleed bushing and bowl vent tube must be clean and undamaged.

c. Throttle Body and Governor Housing. The bore must be free from carbon deposit where the throttle valve seats. All carburetors are subject to this deposit after prolonged low speed operation. Wet or dry flint paper aids greatly in removing it. Blow out passages and governor housing with compressed air.

d. Small Parts. Soak small parts in dry-cleaning and dry with compressed air. Parts which are to be replaced, such as those listed below, need not be cleaned. When the carburetor is completely overhauled, the installation of a repair parts package is recommended and includes the following parts: needle and seat assembly, pump plunger, low speed jet, main vent tube, step-up jet, main metering jet, step-up piston assembly and all necessary gaskets, plugs, screws and lock washers, and wires.

108. CIRCUIT SERVICE METHOD.

a. The overhauling of carburetors by the Circuit Service Method is the fastest and simplest method. By grouping the parts and the installation of such parts in groups, it will be found that each group can be installed completely before proceeding to the next group. It is sug-

gested that the serviceman use a sectionalized pan or muffin tin to separate each group of parts.

109. INSPECTION, REPAIR, AND ASSEMBLY OF LOW SPEED CIRCUIT PARTS.

a. Service Requirements. The throttle bore and idle port must be free from all carbon deposit. CAUTION: *Never loosen or change position of throttle adjusting lock and screw on "T Series" carburetors.* The throttles of all five carburetors are synchronized and a change in throttle opening of one or more carburetors will result in an uneven idle of the Multi-bank Engine. The idle passage air bleed must be clean and unrestricted. The economizer passage in the main body must be clean and its original size unaltered by improper methods of cleaning. The low speed jet must seat tightly in the casting so that only fuel that passes is metered through the calibrated orifice in the tube. The low speed jet has a tapered seat and if not installed securely, fuel will leak past the seat, resulting in an idle mixture that cannot be properly controlled. The main body gasket must not only seal the float bowl, but must also provide a seal for the idle channel. The body gaskets between the main body and the body flange and governor assembly must form an effective seal so that air will not enter the idle passage at this point and alter the mixture. (Only one gasket is required for the later model carburetors—earlier carburetors used two gaskets with an insulator between.)

b. Assembly. Group all parts controlling the low speed circuit, namely: low speed jet, idle port plug, idle adjusting screw and spring. Install low speed jet in main body casting. Install new idle port rivet plug. Install idle adjusting screw and spring.

110. INSPECTION, REPAIR, AND ASSEMBLY OF PUMP CIRCUIT PARTS.

a. Service Requirements. Check balls must be clean and free of gum. The smaller of the two check balls is the intake check ball in the bottom of the pump cylinder. The pump piston, spring, plunger, and rod assembly must be undamaged and not worn. Damage to any one part necessitates the replacement of the entire assembly. One, and only one, gasket must be installed in the vacuum cylinder above the pump piston. If the pump plunger assembly is not up to standard, its rate of travel will be changed, and hence the discharge of the accelerating pump will be impaired. The pump jet must be clean and undamaged; also, it is important that the pump jet be seated securely in the casting. A large rivet plug is installed in back of the pump jet and should be replaced with a new one each time it is removed.

b. Assembly. Group all pump circuit parts, namely: pump plunger assembly, intake check ball and retainer, discharge check ball, spring and plug, pump jet and plug. Install intake check ball and retainer in bottom of pump cylinder. Intake check ball is the smaller of the two check balls. Install pump plunger assembly. Install discharge check ball, spring and plug. Install pump jet and new pump jet rivet plug.

111. INSPECTION, REPAIR, AND ASSEMBLY OF HIGH SPEED CIRCUIT PARTS.

a. Service Requirements. All parts must be clean and not worn or damaged. The main vent tube and plug assembly and the main metering jet must be properly installed. Step-up piston spring must be undamaged and the exact one specified. Step-up piston must not be worn, for an air leak at this point would permit the step-up device to open the step-up jet sooner than required. When the step-up piston is held down against the one step-up piston gasket in the step-up cylinder, the step-up rod head will clear the washer on the step-up piston and plate by 0.010 inch or more indicating that step-up rod has bottomed in the step-up jet. The use of an extra step-up piston gasket would cause the step-up piston and plate to hold the step-up rod off the seat in the step-up jet. The passage connecting the step-up piston cylinder to manifold vacuum extends through the main body and body flange to the face of the carburetor mounting flange. A manifold gasket with four slots is provided so that no matter which way the flange gasket is installed, one of the four slots will connect the vacuum passage to the manifold vacuum.

b. Assembly. Group all high speed circuit parts, namely: main metering jet, step-up jet, step-up gasket, spring, main vent tube and plug assembly, and step-up piston assembly. Install main metering jet and step-up jet. Install step-up gasket, spring, and step-up piston assembly. All parts to the high speed circuit have now been installed except main vent tube plug assembly which must be installed after bowl cover has been installed.

112. INSPECTION, REPAIR, AND ASSEMBLY OF FLOAT CIRCUIT PARTS.

a. Service Requirements. The bowl must be effectively sealed with a new gasket, since it is imperative that air enter the bowl only through the calibrated bowl vent. The floats must not be loaded, damaged or worn. As shown in figure 64, both of the two bodies must be equidistant from the top of the float bowl. When alining the floats, care must be exercised not to exert pressure on the float bodies as a leak might result at the soldered seams. The needle valve and seat must be clean and not worn. In carburetors into which a filter is

T-SERIES TANK CARBURETORS AND MODEL ETW1 CARBURETORS (BALL AND BALL DOWNDRAFT WITH BUILT-IN GOVERNORS)

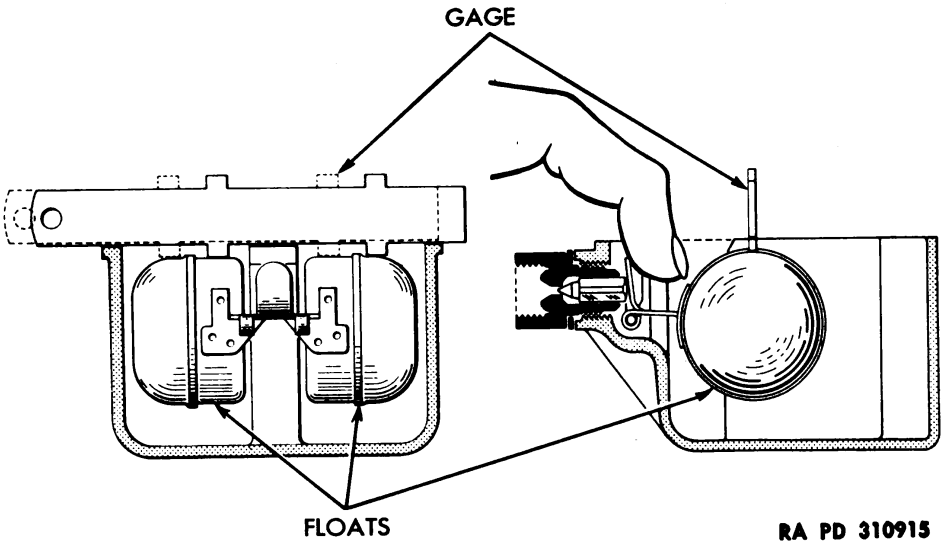


Figure 64 — T-Series Float Adjustment

incorporated, the element must be clean, undamaged and securely installed.

b. Assembly. Group all float circuit parts, namely: float and lever assembly, pin, needle and seat assembly, filter, filter cap, and gasket. Install float and lever assembly and pin. Install needle seat assembly. Be sure that bakelite needle is not chipped, also that floats do not rub against sides of bowl. Set float level as shown in figure 64. Top of float should be $\frac{5}{64}$ inch, plus or minus $\frac{1}{64}$ inch, below top surface of carburetor body casting. Install float pin retainer after setting float.

113. INSPECTION, REPAIR, AND ASSEMBLY OF CHOKE CIRCUIT PARTS.

a. Service Requirements. The air horn must be clean and undamaged. The choker valve must not drag on the inner walls of the air horn. Idle passage air bleed must be clean and undamaged.

b. Assembly. Group all parts controlling the choke circuit, namely: choker shaft, spring and levers, choker valve and screws (choke tube bracket and screws). Install bowl gasket and air horn on main body casting. Install main vent tube and plug assembly. Slide choker shaft into place and install choke valve (with relief valve to the bottom and away from the incoming air). Always use new screws, with toothed lock washers under heads of screws. If unit being serviced is earlier model ("T Series" only), install choker shaft lever. If carburetor being serviced is ETW1, 561S or 567S, install choke tube clamp and bracket assembly, and spring.

ORDNANCE MAINTENANCE — CARBURETORS (CARTER)

114. GOVERNOR ADJUSTMENT (TANK CARBURETORS).

a. Speed Adjustment. All five governors of the tank engines have been synchronized with a dynamometer. Each governor is individually balanced and no adjustment must be attempted except "speed" changes.

(1) FIELD METHOD. In the field the governors can be adjusted only at no load, with the transmission in neutral, and the throttle wide open. To prepare for such an adjustment, connect a vacuum gage to each of the five intake manifolds. With the transmission in neutral and throttle wide open, the tachometer should show an engine speed of 3,000 to 3,100 revolutions per minute and the vacuum gages should show manifold vacuum readings between 15 and 20 inches. To lower the manifold vacuum in one bank, it is necessary to remove the cap covering the governor adjustment boss on the corresponding carburetor, then loosen the brass lock nut by means of the special adjusting wrench (41-W-3734), and turn the adjusting screw **counterclockwise.** (This is done by inserting screwdriver through hollow portion of adjusting wrench (fig. 65).) After each trial adjustment, tighten the lock nut before the engine is again started to observe the effect of the change.

(2) TESTING. The governors can be checked for performance only by driving the tank. With settings that meet the above specifications, the tank's speed on a level hard road should be approximately 25 miles per hour. If the road speed falls as much as 1 mile per hour below this figure, the governors may be at fault. Whether they are or are not can best be determined by installing a new set of five and rechecking. Under no circumstances should the governor speed be adjusted in any way other than the one described above. The lock nut must not be removed from the adjusting screw but merely loosened to permit the adjustment, and then locked in place before testing.

b. Idle Adjustment.

(1) Connect a vacuum gage to each of the five intake manifolds. There is a ⅛-inch pipe plug at the end of each manifold to facilitate this connection. Set all idle adjusting screws one turn open from seated position.

(2) Disconnect all throttle rods from the carburetors and hold all throttle levers closed by providing a temporary pull-back spring for each lever.

(3) Manifold vacuum readings should not differ more than 1 inch from highest to lowest reading. To reduce the vacuum spread, back off the throttle lever set screw of those carburetors providing lower manifold vacuum readings than the average for the five banks. Turn throttle lever set screw clockwise on those carburetors having higher than average manifold vacuum readings.

T-SERIES TANK CARBURETORS AND MODEL ETW1 CARBURETORS (BALL AND BALL DOWNDRAFT WITH BUILT-IN GOVERNORS)

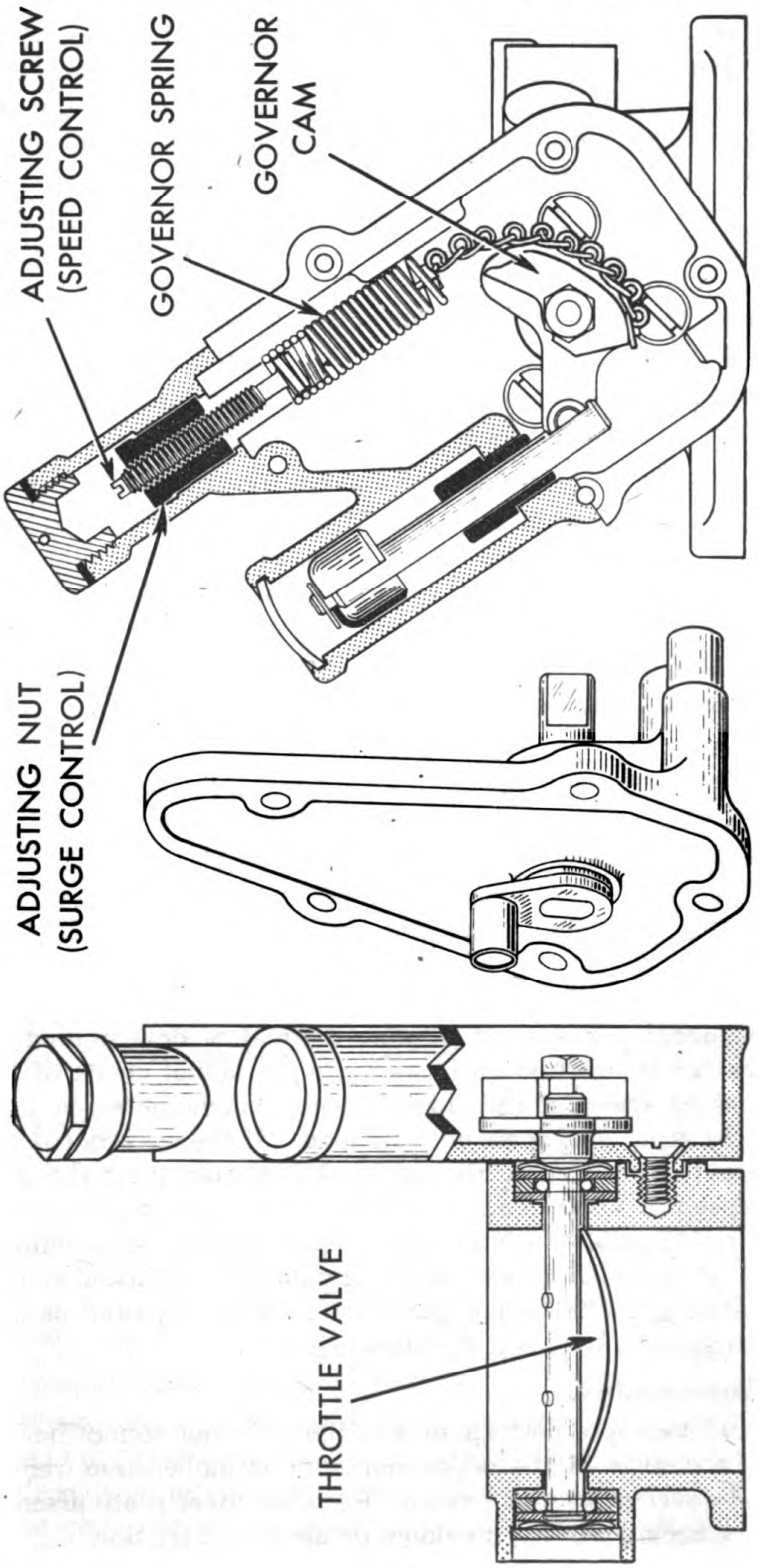


Figure 65 — Speed Governor

(4) The idle speed should be set between 650 and 700 revolutions per minute engine speed (580 to 600 power shaft speed). When adjusting to this speed, turn each set screw the same amount in order to avoid increasing the spread between the manifold vacuum readings. Be sure to lock throttle lever set screws with jam nuts before checking the effect of a change in setting.

(5) Install the throttle connector rods, adjusting their length so as not to force any one of the carburetor throttle levers further open or further closed. To obtain this condition with the least amount of cut-and-try, install the rods in the following sequence:

(a) First rod between No. 3 and No. 2 carburetors

(b) Second rod between No. 2 and No. 1 carburetors

(c) Third rod between No. 1 and No. 5 carburetors

(d) Fourth rod between No. 5 and No. 4 carburetors

(6) The rods should be adjusted with sufficient care so that when all carburetors are returned to idle by pulling on the main control rod, the manifold vacuum readings will still show a spread of no greater than one inch from the highest to lowest reading.

c. Governors That Cannot Be Adjusted.

(1) If there is evidence of excessive friction in the governor mechanism, governor is probably unsatisfactory and should be replaced.

(2) If working the throttle manually reveals that there is no spring action within the governor tending to open the throttle, the governor is broken and must be replaced.

(3) If governor cannot be set to meet the requirements given above, it should be considered faulty and replaced.

115. GOVERNOR ADJUSTMENT (ETW1 CARBURETOR).

a. General. The most reliable method of determining whether the governor is functioning properly, is an actual check of the maximum engine speed at full throttle with a tachometer, or by a road test in low gear, level road, with no load. If the governor is functioning properly and is correctly adjusted, it should limit the maximum engine speed of 3,000 to 3,200 revolutions per minute, or a road speed of 6½ to 7½ miles per hour in low gear with no load, without fluctuation. If governor is inoperative or cannot be adjusted as described in subparagraph **c** following, governor must be repaired as described in subparagraphs **b**, **c**, and **d**, following:

b. Disassembly.

(1) If improper performance of the governor cannot be corrected through a change of the adjustments, or is inoperative, remove seal wire and cover attaching screws. Remove cover plate assembly and gasket. Check parts for breakage or abnormal friction.

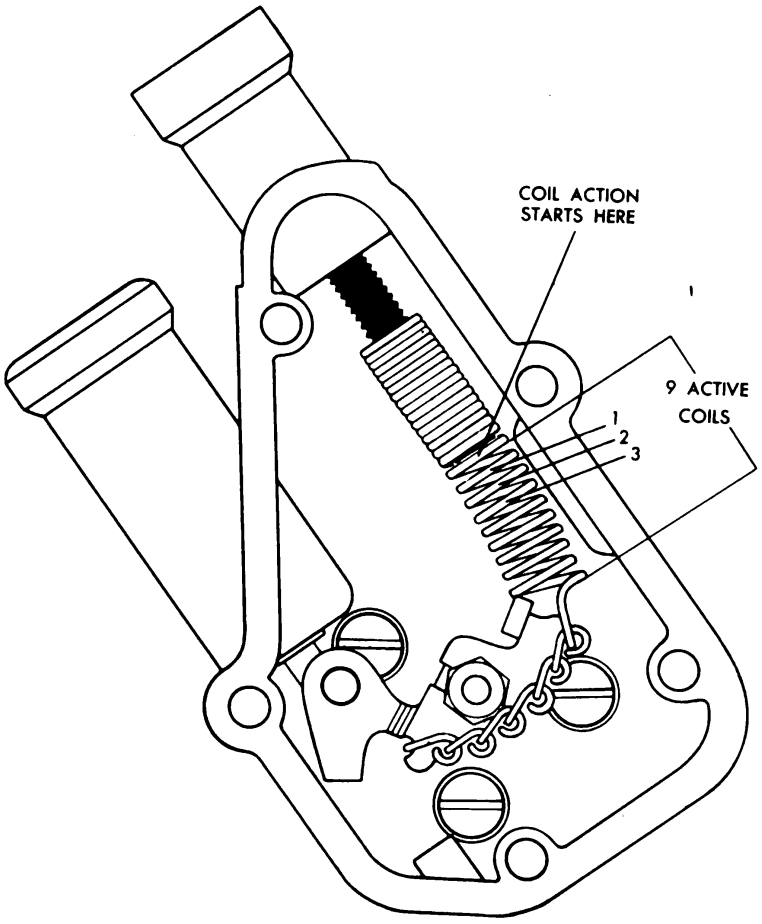


Figure 66 — Bench Governor Adjustment — Counting Coils

(2) Bend the lock washer ears away from cam retaining nut and remove nut and cam. If cam is tight on shaft, pry gently and evenly. Remove adjustment passage plug and turn adjusting screw clockwise until it is free of the adjusting nut. Hold spring and turn screw counterclockwise to remove screw from spring. Do not remove the countersunk screws securing housing to body flange unless governor housing is damaged.

c. Cleaning, Inspection, and Repair.

(1) Wash all parts in dry-cleaning solvent and blow out with compressed air. If rod does not slide freely in and out of the cylinder, or if the threads in the cover attaching screw holes have been stripped, replace the governor housing assembly. **Do not oil plunger shaft.**

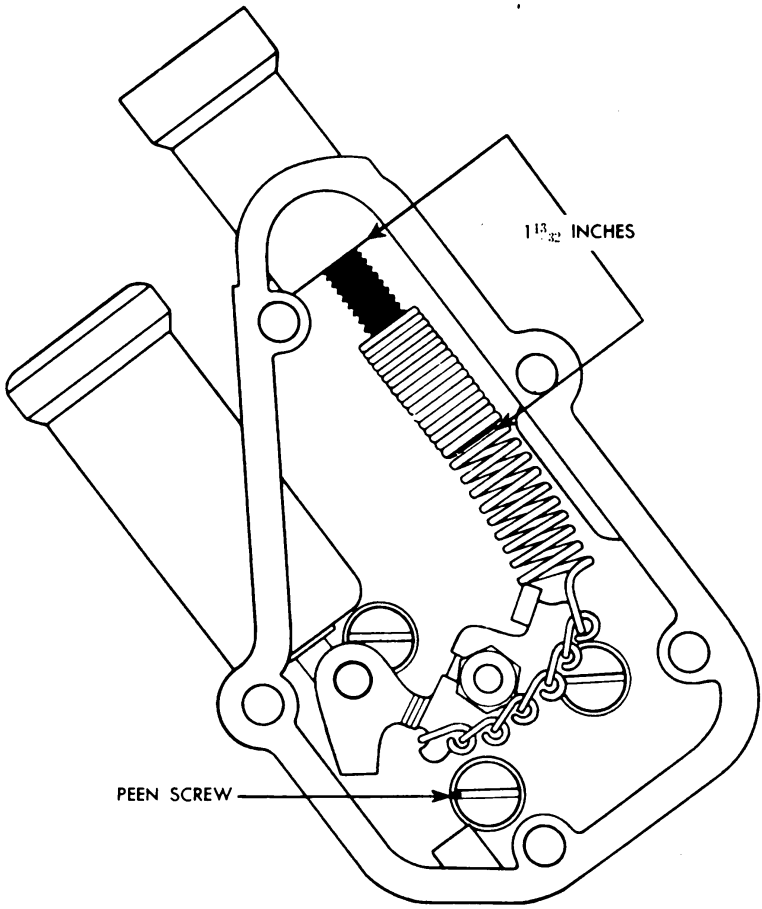


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Figure 67 — Bench Governor Adjustment — Adjusting Screw Measurement

If threaded portion or slots in adjusting nut in governor housing have been damaged, install new adjusting nut. Adjusting nut must be removed from governor housing by using a drift punch from within the housing and driving the nut toward the outer opening. A rawhide or fiber is preferable to prevent damage to inner surface of adjusting nut channel. Adjusting nuts are of two sizes and **are not interchangeable.** The smaller adjusting nut is brass while the larger nut is die cast and grey in color. Both adjusting nuts are in the repair parts package to provide the correct part for the large or small bore housing. When making a replacement, make certain the new nut is a duplicate of the one removed.

(2) Install the new adjusting nut by sliding it into place. With

the threaded end down and the wide slot for the adjusting wrench up, insert the adjusting wrench (41-W-3734) and tap lightly on tool until nut bottoms in the housing casting.

(3) Inspect governor spring and if it is distorted or does not close squarely when released, replace the spring. If chain links show wear, or cam shows wear or damage, these parts should be replaced. Be sure that adjusting screw is straight and threads have not been damaged. The repair parts package consists of the following: governor adjusting screw cap, both early and late production adjusting nuts, spring, adjusting screw, cam, chain, throttle shaft nut, and all necessary attaching screws, locks washers, and gaskets, and sealing wire.

NOTE: *Early production used an adjusting screw threaded throughout its length, the coiled portion of the spring measured 1⅛ inches and contained 26 coils. Later production uses a screw wherein the thread starts ⅞ inch from the fluted head and the spring contains only 16 coils. Both parts used must be either early or late production; do not use one early production part in combination with a later production part.*

d. Assembly.

(1) REPLACE GOVERNOR HOUSING SCREWS. If governor housing has been removed from flange assembly, governor housing screws must be peened in place (using blunt chisel or punch) to prevent loosening of screws due to vibration.

(2) INSTALL ADJUSTING SCREW AND SPRING. Screw the adjusting screw into the spring until the head of screw is flush with the chain end of the spring. Hook chain to spring and engage extended end of spring in the slot in housing. Insert screw driver through the adjusting nut and turn screw counterclockwise through the nut until nine coils of the spring are free from the head of the adjusting screw (fig. 66). Hold the spring open and measure the distance from the end of the screw in the spring to the cylindrical boss in the housing. This measurement should be $1\frac{13}{32}$ inches. Turn adjusting nut with special wrench (41-W-3734) to correct the measurement (fig. 67), while holding adjusting screw in place.

(3) Hook free end of chain to the cam, and while holding throttle open, install cam on throttle shaft, making sure that cam roller is in slot of piston rod. CAUTION: *Cam must be pressed on shaft with finger pressure and drawn down with lock nut. Tapping the cam or end of shaft will ruin shaft bearings, as grooves in the throttle shaft form the ball races for the bearings.* Install lock nut washer on end of shaft and bend washer ears to lock nut in place. Install governor housing cover plate and gasket while holding throttle lever in wide-open

position. One cover plate attaching screw is drilled and should be located near adjusting screw passage plug to accommodate sealing wire.

e. Adjustment of Governor On Engine.

(1) Run engine until normal operating temperature is reached. Manifold vacuum should be at least 16 inches with engine operating at full throttle (governor operating) and at least 17 inches at idling speed, with an allowable reduction for altitude. The adjusting screw, which is attached to the spring, controls the maximum engine speed. Remove the adjusting screw passage plug and turn the screw clockwise to decrease, or counterclockwise to increase the maximum engine speed. Adjust the governor to maximum engine speed of 3,000 to 3,200 revolutions per minute or a road speed of 6½ to 7½ miles per hour in low gear with no load. The screw adds to or subtracts from the number of active coils in the spring when it is turned, automatically calibrating the tension and stability of the spring so that it is generally possible to regulate the maximum engine speed over a considerable range by means of the adjusting screw. If surge (continued rapid rise and fall of engine speed at full throttle) is present or occurs through change of the screw adjustment, eliminate it by moving the adjusting nut clockwise one-fourth turn at a time with special wrench (41-W-3734), correcting the engine speed with the adjusting screw, until the surge is eliminated. If governor is slow acting (governor too "flat"), move the adjusting nut counterclockwise one-fourth turn at a time, correcting the engine speed with the adjusting screw until slight surge is apparent, then remove surge as outlined above.

(2) Engines operate most efficiently when the governor is adjusted to the point which just eliminates surge at full throttle. Do not forget to install adjustment passage plug and sealing wire after making adjustment.

CHAPTER 10

TOOLS

116. COMMON TOOLS.

a. Common tools specific to vehicles equipped with Carter carburetors are listed in the pertinent Organizational Spare Parts and Equipment Lists.

b. The organizational mechanic's carburetor tool-set is listed in SNL N-19.

117. SPECIAL TOOLS.

a. SNL G-27, Volume One lists maintenance tool sets for use by third and fourth echelon maintenance establishments. In addition, SNL G-27, Volume One lists special tools designed specifically for repair of Carter carburetors. The special tools required for the operations described in this manual are listed below:

Name of Tool	Federal Stock Number	Manufacturer's Number
Bender, throttle connector rod and ring inserter	41-B-533	T109-75
Extractor, rivet	41-E-557	T109-43
Gage, float and unloader (3/8-in.)	41-G-196-25	.....
Gage, float level (5/64-in.)	41-G-187	.....
Gage, metering rod (2.795-in.)	41-G-234-55	T109-25
Gage, metering rod (2.817-in.)	41-G-234-50	T109-26
Gage, metering rod (Type WDC)	.....	T109-163
Gage, universal pump stroke	41-G-256	T109-117S
Puller, nozzle	41-P-2951-10	T109-55
Wrench, double-end (1/4- x 5/16-in.)	41-W-910	T109-76
Wrench, governor speed adjustment	41-W-3734	.....
Remover, ball retaining ring	41-R-2370-10	T109-56
Remover, main vent tube	41-R-2384-25	T109-70

REFERENCES

PUBLICATIONS INDEXES.

The following publications indexes should be consulted frequently for latest changes to, or revisions of the publications given in this list of references and for new publications relating to materiel covered in this manual.

Introduction to ordnance catalog (explains SNL system)	ASF Cat. ORD-1 IOC
Ordnance publications for supply index (index to SNL's)	ASF Cat. ORD-2 OPSI
Index to ordnance publications (lists FM's, TM's, TC's, and TB's of interest to ordnance personnel, MWO's, BSD, OPSR's, S of SR's, OSSC's, and OFSB's includes alphabetical listing of ordnance major items with publications pertaining thereto)	OFSB 1-1
List of publications for training (lists MR's, MTP's, T/BA's, T/A's, FM's, TM's, and TR's concerning training)	FM 21-6
List of training films, film strips, and film bulletins (lists TF's, FS's, and FB's by serial numbers and subject)	FM 21-7
Military training aids (lists graphic training aids, models, devices, and displays)	FM 21-8

STANDARD NOMENCLATURE LISTS.

Cleaning, preserving and lubrication materials, recoil fluids, special oils, and miscellaneous related items	SNL K-1
Soldering, brazing and welding materials, gases and related items	SNL K-2
Interchangeability chart of ordnance maintenance tools for combat vehicles	SNL G-27 Vol. 2
Ordnance maintenance sets	SNL N-21

REFERENCES

Tools, maintenance, for repair of automotive vehicles	SNL G-27 Vol. 1
Tool sets for ordnance service command, automotive shops	SNL N-30
Tool sets—motor transport	SNL N-19

EXPLANATORY PUBLICATIONS.

General.

Basic maintenance manual	TM 38-200
Military motor vehicles	AR 850-15
Fuels and carburetion	TM 10-550
Motor vehicle inspection and preventive maintenance service	TM 9-2810
Standard military motor vehicles	TM 9-2800
Cleaning, preserving, lubricating, and welding materials and similar items issued by the Ordnance Department	TM 9-850
Precautions in handling gasoline	AR 850-20

Decontamination.

Chemical decontamination materials and equipment	TM 3-220
Decontamination of armored force vehicles	FM 17-59
Defense against chemical attack	FM 21-40
Military chemistry and chemical agents	TM 3-215

ORDNANCE MAINTENANCE — CARBURETORS (CARTER)

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NOTE: Carburetors are distinguished by type designations. Model numbers are only included in the index for type W-1 carburetors.

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